Montana Outdoors

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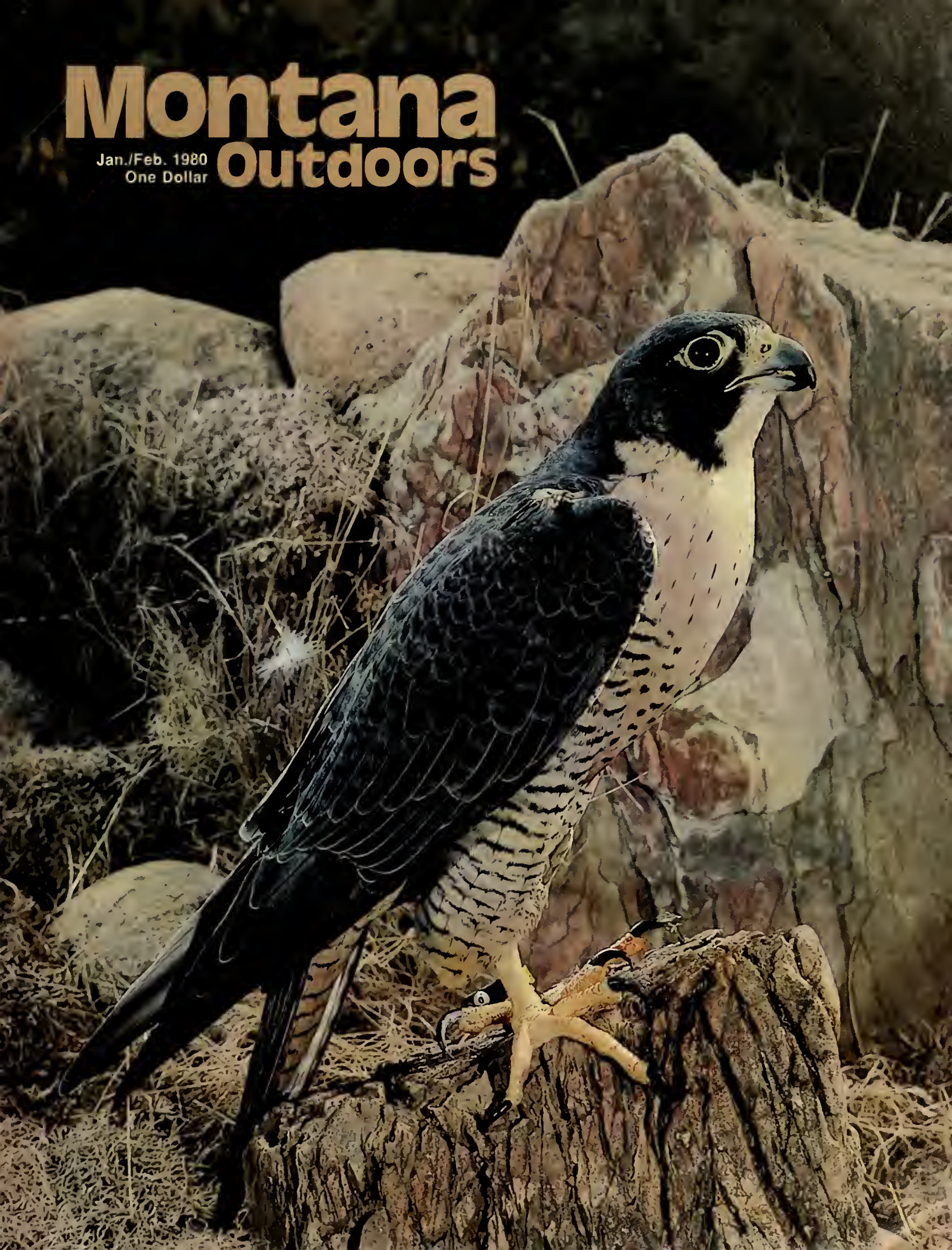

Montana Outdoors

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THE COVER: A free-flying peregrine, such as the one in the front cover photograph by Alan G. Nelson, is truly a "shark of the air." At the moment of hitting its prey, a peregrine may be traveling at 200 miles per hour. For the story of a peregrine stricken with botulism and its "Return to the Sky," turn to Bill Pryor's article on page 7. For an update on the status of this endangered species in Montana, turn to Dennis Flath's article on page 31. The panoply of colors displayed by rainbow trout is aptly illustrated in Glenn West's back cover watercolor. One of Montana's native species, the rainbow is also one of 14 fishes of "special concern." To find out why, turn to George Holton's article on page 2.

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The Director's Column

The early 19th century was a period of great zoological field trips. In spring of 1805, Lewis and Clark crossed into Montana and recorded the first scientific observations of such animals as the prairie rattlesnake and the grizzly bear. In 1833, a German naturalist named Prince Maximilian of Wied came up the Missouri River to study wildlife, while his artist-companion, Karl Bodmer, made drawings of the animals and the terrain. Ten years later, John James Audubon ascended the Missouri and the Yellowstone to the eastern edge of Montana, collecting specimens from which to do his paintings. And at about the same time, in 1831, a 22-year-old Englishman (whose father felt he should settle down into a serious job) left London on a voyage around the world that would take five years of his life. This explorer never reached the Missouri headwaters, but his trip added more to our understanding of Montana's wildlife than all of the fine early work by Lewis and Clark, Maximilian and Bodmer, and Audubon. The Englishman's name was Charles Darwin.

Darwin spent 20 years thinking carefully about what he had seen on his journey and then, because another man was about to scoop him, rather quickly he wrote a book. In it he tried to answer the central zoological question, over which scientists and churchmen had argued for hundreds of years. The question has two parts: (1) what is the source of variety among living creatures, and (2) what determines that some species will survive while some die, some will prosper while some only muddle through, some will dominate the earth for a time and others who formerly dominated will disappear totally? This is the riddle of death and change, the riddle of evolution, the riddle of existence. Darwin supplied one half of an answer. Because more creatures are constantly being born than can ever find food or habitat, he explained, the process of *natural selection* determines that the most fit species will survive while the ill-equipped perish. He titled his book "On the Origin of Species," but this was false advertising, since Darwin never did explain the *origin* of variety among creatures. That half of the riddle was left to a quiet Austrian monk named Gregor Mendel.

In 1866, Mendel published a paper, based on his experimental crossbreeding of garden peas, that described what is now known as "the particulate system of heredity." Mendel had discovered *genes*—the fundamental units of code by which physical attributes are passed down through living generations. Unfortunately, no other scientists discovered Mendel, and for 35 years his scholarly paper remained overlooked on a few dusty library shelves. Then in 1900 it was rediscovered and, joined with Darwin's ideas, provided a more complete answer to the great riddle.

Survival and adaptation by living creatures—evolution itself—is the result of natural selection operating on an unimaginable variety of possible characteristics: long necks and thick hair and sharp teeth, speed and good eyesight and protective coloration, feathers and fins and shells that can be pulled shut from inside, upright posture and enlarged brains and hands with opposable thumbs. That vast but finite variety, in turn, is the result of genetic diversity—the total number of living combinations into which the world's total number of differing genes can be arranged. The crucial importance of this diversity has led scientists to invent a special name for the roster of genetic possibilities. They call it the *gene pool*.

The gene pool is nothing less than a reservoir of potential answers to the continually changing problem of survival on earth. Each time a species disappears, the gene pool is irretrievably reduced, and all living creatures suffer a loss of options. If the *Penicillium* fungus had gone extinct when the dodo bird did, for instance, many thousands of additional humans by now would have died of pneumonia and diphtheria. With varying success, the problem of species survival has been faced by giant reptiles and woolly mammoths, by Audubon sheep and passenger pigeons, by peregrine falcons and snail darters. It is faced no less by *Homo sapiens*.

Two hundred years before Darwin's voyage, another Englishman wrote:

> No man is an island, entire of itself;
> every man is a piece of the continent,
> a part of the main; if a clod be washed
> away by the sea, Europe is the less . . .
> and therefore never send to know for whom
> the bell tolls; it tolls for thee.

John Donne, himself no believer in evolution, might as well have been speaking about the gene pool. Variety, as he understood, is not just the spice of life. It is the key to all survival.

graphics: Jeff Oens

Robert F. Wambach

The Riddle of Existence:

Fishes of "Special Concern"

by George Holton

illustrations by Glenn West

GAME species have long been protected in Montana, but official efforts have lately begun on behalf of nongame wildlife as well. In 1973, the Montana Legislature passed the Nongame and Endangered Species Conservation Act, declaring a state policy to perpetuate nongame as well as game species of wildlife. In pursuit of this double goal, the Department of Fish, Wildlife and Parks (DFWP) has identified species of "special interest or concern."

Montana has 14 fishes (13 species) of "special concern." Each is native (indigenous), restricted in range and, in most cases, limited in numbers in Montana. With further adverse impacts on its numbers or habitat, each is especially vulnerable to elimination from the state.

Some are of more concern than others. For example, the pallid sturgeon which is in trouble throughout its range in North America is of more concern than the trout-perch which, although found only in one place in Montana, has a widespread range across the northern United States and Canada.

Species will be added to or dropped from the "special concern" category as their status changes or new information is obtained. No Montana fishes are currently on the U.S. Department of the Interior's official list of threatened and endangered species. The "special concern" category has been established with the hope that no Montana fishes ever will be.

The 14 designated fishes can be grouped in three classes, reflecting levels of concern:

Class A—limited numbers and/or limited habitats both in Montana and elsewhere in North America; elimination from Montana would be a significant loss to the gene pool of the species or subspecies.

White sturgeon (*Acipenser transmontanus*)

Pallid sturgeon (*Scaphirhynchus albus*)

Paddlefish (*Polyodon spathula*)

Yellowstone cutthroat trout (*Salmo clarki bouvieri*)

Arctic grayling (*Thymallus arcticus*)

Class B—intermediate between classes A and C. Limited numbers and/or limited habitats in Montana; fairly widespread and fair numbers in North America as a whole; elimination from Montana would be at least a moderate loss to the gene pool of the species or subspecies.

Westslope cutthroat trout (*Salmo clarki lewisi*)—includes upper Missouri cutthroat trout

Native rainbow trout (*Salmo gairdneri*)

Sturgeon chub (*Hybopsis gelida*)

Sicklefin chub (*Hybopsis meeki*)

Shorthead sculpin (*Cottus confusus*)

Class C—limited numbers and/or limited habitat in Montana; widespread and numerous in North America as a whole; elimination from Montana would be only a minor loss to the gene pool of the species or subspecies.

Shortnose gar (*Lepisosteus platostomus*)

Finescale dace (*Phoxinus neogaeus*)

Trout-perch (*Percopsis omiscomaycus*)

Spoonhead sculpin (*Cottus ricei*)

All 14 fishes belong within seven larger families: sturgeon, paddlefish, gar, minnow, trout-perch, sculpin and trout.

PRIMITIVE FISHES

Three families—sturgeon, paddlefish and gar—are primitive fishes with fossil evidence from past geological ages. They have retained primitive features and can be considered remnants of ancient life.

STURGEON FAMILY

The **white sturgeon** is found mostly in Pacific Coast streams, where it is anadromous (spending part of its life at sea and ascending rivers to spawn). In the upper Columbia

River drainage, including Montana, the white sturgeon is landlocked. In Montana, it is found only in the Kootenai River below the falls. But according to a 1978 study, apparently even here its numbers have declined. Downstream from Montana, landlocked sturgeon are more numerous. Yet recent information from Idaho, Washington and British Columbia indicates concern about the physical and ecological effects of dams, water withdrawal and possible pesticide poisoning. The decline of white sturgeon in Montana seems linked to changes in the Kootenai's flow pattern resulting from Libby Dam (completed in 1972).

The 1971 Montana Legislature designated the white sturgeon a game fish. From July 1, 1971 until 1979, the limit was two fish per person per year, with restrictions on maximum and minimum length. New fishing regulations prohibit taking or possessing a white sturgeon and, until more is known about their status in Montana, this protection should continue.

The **pallid sturgeon**, another game fish, has been found in the Missouri River, including Fort Peck Reservoir, as far upstream as Fort Benton, and in the Yellowstone River downstream from the mouth of the Tongue River. Today it is seldom seen, but we do not know whether its numbers have diminished or whether it was always scarce in Montana. It is also rare in downstream states. The Endangered Species Committee of the American Fisheries Society in 1979 designated the pallid sturgeon a threatened species. This means the committee believes it "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

Maintaining Montana's pallid sturgeon depends on protecting its habitat, particularly from barriers and dewatering. Care must also be taken to prevent overharvest, which is unlikely since so few are taken.

PADDLEFISH FAMILY

The **paddlefish**, once abundant in the Mississippi-Missouri River system, has declined to only six major reproducing populations, two in Montana. Of these two, one is an interstate population: Paddlefish from Garrison Reservoir in North Dakota migrate each spring up the Missouri into Montana. Part of this population branches off and ascends the Yellowstone to spawn, while the rest continues up the Missouri to Fort Peck Dam. The only known spawning here occurs in the lower reach of the Milk River. Just below Fort Peck Dam are water-filled dredge cuts (the dredge cuts were sources of earth for Fort Peck Dam) and, during the summer, as many as 4,000 paddlefish congregate in the cuts. Some of the fish also winter here, but apparently none use the dredge cuts for spawning.

The other reproducing population lives entirely within Montana. It inhabits the reservoir above Fort Peck Dam and makes spawning runs up the Missouri River.

As with every species, the cornerstone in maintaining Montana's paddlefish is habitat preservation, and *all possible efforts will be made*. Yet these fish are long-lived (20-year-old paddlefish are common) and relatively slow to mature sexually (males spawn at 7-8 years, females at 12-14 years), so a depleted population would take many years to rebuild. Therefore care must be exercised to prevent overharvest. In 1979, the American Fisheries Society's Endangered Species Committee listed the paddlefish as meriting "special concern" throughout its U.S. range. Our studies indicate the Montana populations are stable. However, to be on the safe side, statewide fishing limits, formerly two per day and in possession, were reduced in 1978 to one per day and two in possession. The department will continue to monitor population numbers and age structure and will be prepared to further reduce harvest if the future of paddlefish in Montana seems jeopardized.

GAR FAMILY

Although the **shortnose gar** is common in the Mississippi-Missouri system, in Montana—at the upper limit of its range—it is quite rare. Each year, just two or three are reported from the dredge cuts below Fort Peck Dam, and only one has ever been recorded from the Missouri River proper. This single

Montana has 14 fishes . . . of "special concern." Each is native . . . and with further adverse impacts on its numbers or habitat, each is especially vulnerable to elimination from the state.

fish was caught in August 1979 by department biologist Phil Stewart, 32 miles below the dam, at the mouth of Little Porcupine Creek. A nongame fish, the shortnose gar has never, to our knowledge, been more numerous in Montana.

SMALL FISHES

Five fishes of special concern are inconspicuous and not used for food or sport. They are members of the minnow, trout-perch and sculpin families.

MINNOW FAMILY

Although the **finescale dace** appears at scattered locations in Canada and the northeastern United States and as an ice age relict in Nebraska, Wyoming and South Dakota, it has never been recorded in Montana. Evidence of its existence here comes only from hybrids—crosses between finescale and northern redbelly dace—taken over the years from nine streams in the Missouri River basin.

The **sturgeon chub** lives in the currents of turbid streams, over bottoms ranging from rocks to coarse sand. It has a spotty distribution in the Mississippi drainage, from southern Illinois upstream to Montana. Dr. C. J. D. Brown reported in "Fishes of Montana" (1971) that the first Montana specimens were taken from the Milk River, during the Pacific Railroad surveys of 1853-55. It has apparently not been found in that drainage since. More recently, sturgeon chub have been collected from the Teton River, the lower Yellowstone River and three Yellowstone tributaries. According to Dr. George T. Baxter, an ichthyologist at the University of Wyoming, the sturgeon chub is more widely distributed in the upper Missouri drainage than formerly thought; however, it is a sensitive fish with exacting requirements and could be lost if care is not taken to maintain the habitat needed for viable populations.

The first discovery of **sicklefin chub** in Montana occurred during the summer of 1979, when department biologists Rod Berg and Bill Gardner found specimens in the 43-mile stretch of the Missouri River between Cow Island and Fort Peck Reservoir. This discovery apparently marks the upstream limit of the sicklefin's range, which extends down the Missouri-Mississippi system to southern Illinois. Dr. Frank B. Cross writes in "Handbook of Fishes of Kansas" (1967): ". . . the species seems so specialized for life in the large, silt-laden Missouri-Mississippi River that its survival may be threatened by impoundments and other modifications of habitat throughout its limited range."

TROUT-PERCH FAMILY

The **trout-perch** ranges from Alaska, across Canada, to the eastern United States. Yet within Montana it is found in only one place: Lower St. Mary Lake, on the Blackfeet Indian Reservation.

SCULPIN FAMILY

Because little is known of their life history and habits and because available information suggests their Montana ranges are limited, two species of sculpin are cited for special concern. The **shorthead sculpin** is confined to the Columbia River and Puget Sound basins. Montana specimens recorded to date are from the upper Flathead drainage and the St. Regis and Little Blackfoot rivers. The **spoonhead sculpin** is distributed from northwestern Canada to the Great Lakes region. In Montana, it has been found only in Glacier National Park.

SALMONIDS

The trout family includes Montana's most important food and sport fishes: trouts, chars, kokanee (salmon), Arctic grayling and whitefishes. Three trouts and Arctic grayling are of "special concern."

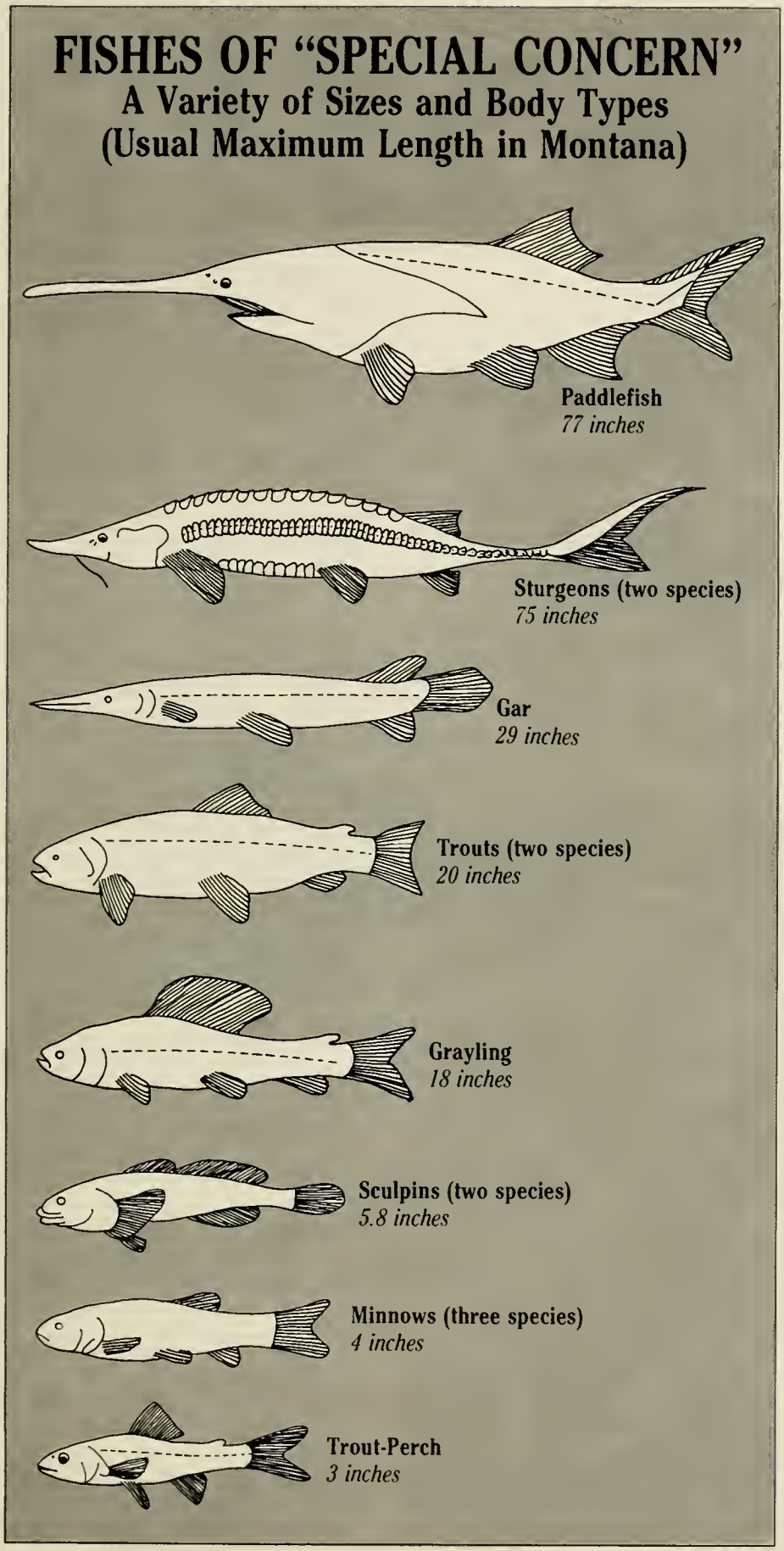
TROUT FAMILY

Montana's official state fish is the "blackspotted cutthroat trout," *Salmo clarki*. This designation encompasses both subspecies of native cutthroat, since both have black spots and belong to the same species. The choice is appropriate, because cutthroat were once abundant in nearly all of Montana's mountain and foothill streams, on both sides of the Continental Divide. Members of the Lewis and Clark Expedition took cutthroat in the Great Falls of the Missouri on June 13, 1805, leading Captain Meriwether Lewis to note in his journal that "the specks on these [trout] are of a deep black instead of the red or goald colour of those common to the U'. States." (Captain Lewis had in mind the brook trout native to eastern North America.)

Two subspecies of cutthroat are native to Montana: the **Yellowstone cutthroat trout**, in the Yellowstone River drainage, and the **westslope cutthroat trout**, in drainages west of the Continental Divide. The westslope cutthroat also appears in a number of streams *east* of the divide, where it is known, for management purposes, as the "upper Missouri cutthroat trout."

Both subspecies are found in many Montana locations, and this gives a sense of security. But are Montana cutthroat really secure? In fact, they have been partly or totally displaced from much of their former range by introduced fishes, including other trout species, kokanee, bass, sunfish and perch. They have been modified by hybridization with rainbow trout or other cutthroat species, where these close relatives were introduced or invaded naturally. And they have lost habitat through stream bank destruction, dewatering, sedimentation and other factors affecting water quality. The westslope cutthroat does have a stronghold in the upper Flathead drainage. But a dam or pollution barrier just above Flathead Lake could eliminate the migratory population that runs up from the lake to spawn in distant tributaries of the Middle and North forks. They are now reasonably safe in the Bob Marshall Wilderness above Hungry Horse Dam; yet even here they are threatened by enclaves of rainbow trout and Yellowstone cutthroat established by stocking years ago. They face additional threats from gas and oil exploration and development.

The typical cutthroat population—and this is especially true east of the Continental Divide—consists of a few hundred to a few thousand fish in a headwater stream: mere rem-



nants of former abundance. Unprotected by barriers, such a population will continue to suffer encroachment by rainbow and brook trout. Unless given consideration, it may also be destroyed by mining, logging, road building, grazing or other resource development.

Genetic differences between populations, even within the same subspecies, make efforts to perpetuate cutthroat more difficult. Such diversity is sometimes reflected in behavioral variations, as when two cutthroat populations differ greatly in the length of their spawning runs. The westslope cutthroat of Flathead Lake migrate as much as 120 miles to spawn in tributary streams; other westslope cutthroat spend their lives in headwater streams and make spawning journeys of a mile or less. Undoubtedly, there are further subtle differences, still undetected by man, between cutthroat populations. Each population has evolved and adapted itself to the particular stream system it inhabits. That isn't to say that some—various headwaters populations, for instance—might not be equally well suited to each other's habitats. Many probably are; but we do not know which are and which are not. In fact, we do not even know how many of the populations we have counted are pure cutthroat and how many are hybrids.

Dr. Robert Behnke, an expert on western trouts, has described the reasoning behind a concern—which we share—for maintaining individual races and subspecies:

"The rationale of perpetuating native races and subspecies centers on the values of perpetuating genetic diversity; and for this we can draw analogies from the history of plant and animal husbandry. The source of genetic diversity necessary for developing new strains ultimately is derived from wild ancestral species. Fishes such as our native trouts are widely propagated but are in danger of losing the broad base of genetic diversity originally found in the species. Indeed, much of the cutthroat species, *Salmo clarki*, has already been destroyed. *A conservative estimate would be that 99% of the original population of S.*

clarki *in the interior regions of the U.S.A. have been lost in the last 100 years . . .*" (emphasis added).*

Perpetuation of cutthroat trout will be aided by: (1) recognizing them as being of special concern, (2) preserving their habitat, (3) preventing the planting of fish in cutthroat waters (except in rare situations where planting native strains may bolster or restore a population), (4) preventing overfishing and (5) where feasible, building barriers to prevent encroachment by competing species from downstream.

As late as 1972, the **rainbow trout** was not considered in fisheries literature to be native to Montana. Although the rainbow was the most common trout in the state, it was generally believed that all populations could be traced to hatchery stock. Yet Elmer Phillips, foreman of the Libby State Fish Hatchery during the 1930s and State Superintendent of Fisheries from 1940-44, persisted in believing that rainbow were native in the lower Kootenai River drainage. In 1977, Darryl Espeland and Dean Scow, students at Carroll College in Helena, undertook a thesis project to determine whether rainbow were, in fact, native to Montana. They were assisted by Dr. Fred Allendorf and Steve Phelps, geneticists at the University of Montana, and by fisheries biologists from the DFWP. Results from the Espeland/Scow study established that Elmer Phillips was right.

Using a biochemical technique, two forms of rainbow trout can be distinguished: coastal form and inland form (the differences between these forms are comparable to the differences among human races). The inland form is native; the coastal form has been the basis for all hatchery stocks used in the state. Espeland and Scow found fairly pure inland form rainbow in Callahan and South Callahan creeks and a mixed population (part native and part coastal) in the Yaak River, thereby showing that rainbow trout are native to Montana. In 1979, a mixed population was also identified in O'Brien Creek, another Kootenai River tributary.

Although North American distribution of remnant inland rainbow populations is not precisely known, experts generally believe it is being overwhelmed and replaced by hatchery rainbow throughout its range. Since rainbow of hatchery ancestry are numerous and widespread in Montana, why try to perpetuate the native form? There are good reasons: The native form is genetically distinct and probably differs in some attributes, such as habitat preference, time and place of spawning, food choice, growth rate or longevity. Such diversity enables a species to survive gradual changes in habitat and adapt to new situations.

The first step in preserving native rainbow stocks must be to identify additional streams where they are present, and then avoid planting hatchery fish which would hybridize with them or replace them. Their habitat should be protected. And, where feasible, they should be transplanted into additional waters as insurance against natural or man-caused elimination.

Although abundant throughout Alaska and northwestern Canada, the **Arctic grayling** is native in the lower 48 states only to Michigan (where it is now extinct) and to the upper Missouri drainage of Wyoming and Montana. During the ice age, these southernmost populations became separated from the main body of grayling hundreds of miles farther north.

When Lewis and Clark explored Montana, the grayling was widespread and numerous in the Missouri drainage above the Great Falls, particularly in streams. Remnant populations are found today in only about 30 streams of this drainage and in perhaps 10 other Montana streams. The American Fisheries Society's Endangered Species Committee in 1979 designated the stream form of Montana Arctic grayling a fish of "special concern." The Montana "special concern" list includes lake-dwelling grayling as well, for only an estimated 35 Montana lakes now have reproducing populations. Three-fourths of the grayling streams and a number of the lakes have competing fish species and many grayling waters sustain only sparse populations.

Competition from introduced fishes and habitat deterioration have been chiefly responsible for the decline. Perpetuation will require preserving its habitat, preventing planting of competing species in grayling waters, guarding against overharvest and introducing grayling into hospitable new waters.

CONCLUSION

Of the 14 fishes discussed above, seven are classified as game fish under Montana law. The question

continued on page 26

* *From a paper given at the 1972 Conference of the Western Association of State Game and Fish Commissioners.*

Return to the Sky

The bird on Wayne Brewster's arm does not at the moment look capable of falling through the air at more than 200 miles per hour to crash into a flying duck, killing it instantly in an explosion of feathers. But that, say the experts, is what this bird was born to do. For it is a peregrine falcon.

At the Castle Rock Fishing Access north of Nye, a group has gathered to witness the release of this peregrine. Wayne Brewster is from the U.S. Fish and Wildlife Service, I represent the Department of Fish, Wildlife and Parks and we are accompanied by several members of the Yellowstone Audubon Society. The date is Sept. 20, 1979. Camera shutters snap steadily, recording the moment, as this peregrine on Wayne's extended arm stands at the brink of freedom.

The bird is as beautiful as a caped gladiator. A helmet of blue-grey feathers sweeps back from the eyes, over the head, down across the shoulders. From below the chin, reddish-brown feathers cascade to midbreast, outlining the white underparts. But most notable are the eyes: black as ink, ever alert.

This peregrine is big news. Peregrine falcons are an endangered species in the continental United States. (In the eastern part of the country, they are called "duck hawks.") Throughout the entire Rocky Mountain West, probably no more than 15 or 20 wild, breeding pairs remain. The bird on Wayne's arm was found, half-dead of botulism, on Aug. 22. Dick Scheustrom, a biologist at Red Rock Lakes National Wildlife Refuge, was in an air boat, working his way across Big Lake, northwest of Billings, putting the soggy corpses of botulism-killed ducks into plastic garbage bags. Suddenly Dick noticed a fluttering on shore that was not ducklike. It turned out to be a peregrine falcon, wings drooping, unable to grasp with its talons, unable even to walk.

People were concerned. Wayne took the bird first to a Billings veterinarian, but its response to treatment was not promising, and there seemed a need for more drastic action. On Aug. 25, the peregrine was flown by commercial jet to Denver, and driven from there to Dr. Dave Remple's veterinary clinic in Laramie, Wyo. Remple knows peregrines. He is a falconer—a person who keeps hawks and falcons and flies them for sport. He has taken care of another naturally reared peregrine, and done extensive work with captive birds at Cornell University. He also works with The Peregrine Fund, Inc., a group trying desperately to re-establish peregrine populations by releasing captivity-reared birds back into the wild, at a rate of 150 per year.

Remple administered vitamins, antibiotics, clean water and a diet of one pigeon daily to the slowly recovering peregrine. Botulism fouls the electrical impulses that drive an animal's muscles; without adequate muscle response to its neural messages, this bird is helpless, locked in a feathered sarcophagus. It has probably contracted its illness from eating botulistic ducks. Kept away from the source of poisoning, an animal can pass the botulin out of its system, unless it is already beyond help. The peregrine was not that bad off. It began responding to Remple's care.

At capture, the bird weighed 26 ounces. In a month, it had recovered to 30 ounces. It was a young female, out of its juvenile molt and probably about 14 months old. It would not be mature and capable of producing offspring until the age of 3. The young bird was wild, and had probably been hunting ducks drawn to Big Lake, unaware that its prey was tainted.

Wayne Brewster prepares to release a recovered peregrine falcon back into the wild. DFWP photo: Bill Pryor.

Under Remple's care, daily exercise built back the lost muscle tissue on its keel (breastbone). These muscles drive the wings and are a good gauge of a bird's health. A pigeon a day restored strength to the feeding peregrine, and "pump-ups" restored its muscle tone. Like an athlete in training, it was placed on the floor and encouraged, by a reward of small meat chunks suspended at ceiling height, to pump its way up, gaining wing strength from the exercise. When Remple received the bird, it could not execute a single pump-up. By Sept. 19, when he handed his charge over to a federal wildlife official, the peregrine could complete 10-20 pump-ups in sequence. That regimen simulated the exercise the bird would receive from flying and prepared it for its eventual release. At the end of Remple's treatment, it was devouring one tame mallard a day.

In the wild, peregrine falcons prey on birds of all sizes, shapes and species. Free-flying peregrines in top condition are the sharks of the air. "We've seen them flying at 3,000 feet," said Remple. "They spot a duck below that's flushed and taking to the air. A peregrine's eyesight is about seven times better than a man's. As soon as it spots the prey, it dives. The dive is called a 'stoop' in falconer's jargon."

A peregrine falls so fast that its wings cannot stabilize it, so it tucks them in. At the moment of hitting a duck, a peregrine may be traveling 200 miles per hour. "When that peregrine hits, the duck just explodes in midair," continued Remple. "It's a lot of force, and a guy I know, flying a peregrine after sage grouse, had his bird killed upon impact with the big grouse. But that's a rarity." This killing power is delivered through outstretched legs and clenched feet, which drive into the prey just like a boxer's fist hitting a punching bag. "These birds want to duel it out in the air," Remple said. "If their prey dives

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for the bushes, the peregrine usually resumes altitude and hunts for something else in flight."

Those few remaining peregrines in the Rocky Mountain region are scientifically classified as *Falco peregrinus anatum*. Beside the *anatum* subspecies, there are two others: The Peale's peregrine (*F. p. pealei*), a nonmigrating population, inhabits the Aleutian Islands and down the western coast as far as British Columbia; the tundra peregrine (*F. p. tundrius*) is native elsewhere in the northern latitudes. The Peale's population is stable, but both the *anatum* and *tundrius* are classed as endangered species.

Remple thinks that with reintroduction of 150 birds yearly back into the wild, the *anatum* peregrine may slowly be able to re-establish itself. Yet under even the best conditions, peregrines have a normal death rate of 70%-80% during the first year. And DDT, the bane of the peregrine and the cause of its original decline, is still used in Mexico and South America, to which the birds migrate for winter. So nature and man continue to take a heavy toll on the peregrine falcon, and the vise jaws of imminent extinction are not easily opened.

The peregrine on Brewster's arm today is anxious. A graduate of Remple's therapeutic regimen, it has been brought back to Montana for release in familiar surroundings. With good fortune, in two years it will mate with a male (these are smaller than a peregrine female, weighing only 20 ounces, to the female's 30) and nest on a ledge overlooking marshland or river bottom. Two peregrine chicks will be produced, or possibly three, and this female will guard the nest while the male parent hunts for food.

But that is all still in the future—even in doubt—as the salvaged peregrine clings uncertainly to Brewster's arm. The small crowd assembled in the gravel parking area watches it try a few hesitant wing beats. Brewster releases it, and the bird flaps upward. White feathers on chest, belly and underwings flash against the sky. The bird is airborne.

But barely. It sinks. Just before hitting earth, the freed falcon levels off, then glides slowly along the ground. Then it gradually picks up height, wings outstretched from its blue-grey back. It clears a low bush and lands, 50 yards away, on a fence post. Brewster approaches, gently testing the bird's capability.

It is capable of keeping away from him: It flies 100 more yards to another fence post. The audience sits and watches. The peregrine bends down and up repeatedly, head bobbing. Still perched on the post, it fluffs and ruffles its feathers several times. Twenty minutes pass and the releasers continue to look on expectantly.

All is evidently right for reorientation to the wild. With two good wing beats, the peregrine finally lifts off the post and starts to climb higher in circling flight. To the west of the Castle Rock access, the ridge tops of high foothills are visible; the peregrine is already at that height, circling on strong wings. We watch until it is only a dot, blinking in and out of view, too small to hold steadily in sight.

She is on her own, after her brush with man—free to scream across her lofty altitudes and "stoop" at astounding speeds. The blue sky will have more wonder for us, knowing that such a bird lives in it.—*Bill Pryor*

Jenkins Wins Bird Stamp Art Contest

The winning entry in the 1980 Montana bird stamp contest, painted by Ron Jenkins of Missoula, features male and female Barrow's goldeneyes in flight. Jenkins' painting was selected from 34 entries by a three-judge panel: Dr. Phil Wright, Missoula; Harriet Marble, Chester, and John Michael Marion, Hamilton. Marion won the 1979 contest with a watercolor of snow geese in flight.

Jenkins has been making his living with a paintbrush for over 20 years. In 1965, he won the national duck stamp contest with a painting of canvasbacks. "Some hunters kid me about painting goldeneyes because they aren't a popular game bird," Jenkins noted. "But I love them. They're hardy little ducks, and I spend lots of time watching them each winter right here in Missoula on the Clark Fork River."

For several years, Jenkins' work has delighted **Montana Outdoors** *readers. His paintings appeared on the cover and illustrated the article, "Grouse of Montana," in the Sept./Oct. 1978 issue. In addition, his painting of Canada geese was featured on the cover of the Sept./Oct. 1979 magazine. (Prints of his work are handled by Marie's Art-eries, 702 S.W. Higgins Ave.; Missoula, MT 59801.)*

Jenkins' practice of spending many hours watching wildlife may be one key to his success. Unlike some artists, he rarely paints from photos. Instead, he paints field observations from memory and believes that's "the only way to make sure everything is accurate."

Department of Fish, Wildlife and Parks Director Robert F. Wambach said the stamp will be distributed with the 1980 game bird license. (This $4 stamp is required to hunt upland game birds or waterfowl in Montana.) Since the stamps alone will not authorize hunting and have no license numbers printed on them, they will be on sale to collectors as soon as they are printed.

Film Wins Bronze Medal

"Spirits on the Wing," a 32-minute film which explores the world of raptors (eagles, hawks, falcons and owls), was

recently awarded a bronze medal at the 22nd International Film and TV Festival of New York. The film, written and directed by Craig E. Sharpe, supervisor for the department's motion picture production unit, with special assistance by Michael Gurnett, was entered in the educational documentary category.

Sharpe noted the primary goal of the film was to educate the public about the environmental issues which can either exterminate raptors or ensure their survival. As well as delving into the beauty of flight, the film explains the physical design of the various species of raptors and how this design plays a role in food-taking activities.

"Spirits on the Wing" is the fourth department film to receive recognition from the New York festival.

Loan copies are available, free, from the Film Center, Department of Fish, Wildlife and Parks, 930 Custer Ave. W.; Helena, MT 59601 (406/449-3913).

Wambach Heads Western Association

The states' rights issue that has kept the Western Association of Fish and Wildlife Agencies (WAFWA) busy for the past two years will continue to be a priority in the 1980s, according to the organization's president, Montana's Robert F. Wambach.

Wambach, director of the Department of Fish, Wildlife and Parks, will lead the western association through its 1980 convention to be conducted in Kalispell July 14-17.

The states' rights issue revolves around federal agencies' failure to accept the traditional role of states as custodians of resident fish and wildlife, according to Wambach. "It has been traditional that states have control over resident fish and wildlife, and federal agencies have encroached upon the states in the West, partially because of the amount of federal land and because of laws such as the endangered and migratory species acts," he said.

However, Wambach recognizes that good working relationships are necessary because of the importance of formal management agreements and because federal aid is vital to many state wildlife management programs. This relationship is strong and has existed for at least 40 years, Wambach commented. "However, there is a tendency for the federal agencies to fall into the 'big brother' syndrome rather than to work as a partner in wildlife management. They tend to cater to the national urban block rather than being responsive to the rural needs of the West. And because the urban block represents a larger voting block, the federal agencies take on that paternalistic viewpoint. That's why it is important that the western association be strong, organized and voeiferous, especially in Washington," Wambach said.

He added, "Our perspective is that federal money shouldn't have strings attached. The federal agencies are just the distributors of the funds. The professionals who work on the ground for fish and game agencies throughout the West have a better feel for the wildlife resources and their management needs. Again, we should be working as active partners in the conservation movement," he stressed.

The WAFWA, comprised of 13 western states and three Canadian provinces, has met annually since 1922 to discuss issues of paramount importance to fish and wildlife resource management in the West. The group acts as an active lobbyist and monitors federal and scientific wildlife management issues and impacts.

Before becoming president of the organization in 1979, Wambach had served as chairman of the group's executive committee (1978), as a member of the legislative committee (1976, 1977, 1978) and as a member of the communications committee (1977, 1978). He represented the organization as a lobbyist in Washington when federal nongame wildlife funding legislation was pursued in 1978.

Contributors

As Robert F. Wambach notes in his Director's Column, "With varying success, the problem of species survival has been faced by giant reptiles and woolly mammoths, by Audubon sheep and passenger pigeons, by peregrine falcons and snail darters. . . ." In this issue, we are publishing six articles which probe "The Riddle of Existence."

Beginning on page 2, **George Holton** writes about Montana's "Fishes of 'Special Concern'." These 14 fishes are native to the state, restricted in range and, in most cases, limited in numbers in Montana. As Holton emphasizes, some are of more concern than others, but with "further adverse impacts on its numbers or habitat, each is especially vulnerable to elimination from the state." Holton is the assistant administrator of the department's Fisheries Division and has served as a member of the American Fisheries Society's Endangered Species Committee.

When scientists get together and talk about rare, extinct or endangered species, the chances are good the subject is a creature with fins, fur or feathers, large enough to be seen without a microscope and with a name of less than four syllables. And yet, as **Loren Bahls** writes, ". . . for every creature we *know* to be extinct or in trouble, scores exist—maybe hundreds—about which we know next to nothing." Turn to page 12 for an examination of the status of some of "Our Smaller Cohorts"—the small "nuts and bolts that hold our ecosystems together." Bahls is head of the Water Quality Management Section of the Department of Health and Environmental Sciences Water Quality Bureau. He hopes to prepare a monograph on the distribution and ecology of diatoms in Montana.

The third article in the series looks at the plight of some of "Montana's 'Rare Plants'." Working from lists prepared in 1975 by the Smithsonian Institution and in 1976 by the U.S. Fish and Wildlife Service, the U.S. Forest Service has recommended that four species in Montana be considered for formal "endangered" classification. But as **Bob Gale** warns, "These four should by no means be considered the only Montana flora worthy of statutory protection." He emphasizes that evaluation for official "endangered" classification involves "continuing efforts by federal and state agencies, universities, private firms and interested individuals." Turn to his article, with accompanying photographs of some of the plants, on page 14. Gale is an endangered species biologist stationed at the Forest Service's Northern Region headquarters in Missoula.

The fourth and fifth articles in our series deal with two creatures which have already become extinct: "Audubon Bighorn Sheep" and "Passenger Pigeon." For the Audubon bighorn, the reasons for extinction were complex and involved competition from livestock, homesteading, habitat loss, disease and other factors. Certainly, man played the chief role. Less well known in Montana was the passenger pigeon. But as **Ken Walcheck** points out, from the time of Lewis and Clark and for 70 years afterward, there were recorded sightings in Montana of this "famous vanished creature." The name "passenger pigeon"

came about because the dense masses of birds that once darkened the sky crossed overhead like "interminable passing railroad trains upon which the individual pigeons seemed to be carried as passengers." Their demise may not have been in vain—not if the loss serves as a spur to the "ecological conscience of our later generations, and as a poignant reminder that man's future is inextricably linked to the fate of all other creatures on this planet." The Audubon bighorn sheep article begins on page 17, and the passenger pigeon article on page 22. Walcheck continues his duties as the department's information officer in Miles City.

The final article in "The Riddle of Existence" updates the status of Montana's endangered animal species. **Dennis Flath**, the department's nongame biologist, reminds readers that the present endangered species budget is "just a portion of what could be put to effective use." Tangible benefits to each of Montana's five endangered species—peregrine falcon, bald eagle, whooping crane, wolf and black-footed ferret—would be insignificant if these funds were divided evenly. So, efforts must be selectively focused until more funds become available. Turn to "Montana's Endangered Species" on page 31.

We continue our series on nongame animals with an article about the "Great Horned Owl: White-Throated Hooter." Because of its large size and the two tufts of feathers protruding from its head like ears or horns, this species is not easily confused with other owls. Turn to page 34 for **Stephen Freligh's** article. Freligh, a free-lance photojournalist, does volunteer banding of owls. He has worked with the U.S. Forest Service on a bald eagle study and just returned from two months in Turkey studying a route used by over 400,000 raptors.

We would be remiss if we did not mention the contributions of **David Quammen** to this issue. As editorial consultant, his editing and cautious proofreading eye greatly assisted production. In addition to his duties with this Jan./Feb. issue, he also worked on our Special Hunting Issue, due for publication in February, and on an article to be published in a later issue of *Montana Outdoors*.

Our Smaller Cohorts *continued*

position close to man at the apex. Second, the foundation of the pyramid, upon which all the upper levels depend for support, consists of a vast number and variety of less familiar organisms. In other words, for every leading actor there is a huge supporting cast of unknowns.

But unlike the movies, not every supporting role is necessarily a secondary one. With our imperfect knowledge of ecosystems, it is impossible to say, for example, whether a species of diatom or bug may be the key to survival for the cutthroat trout. Kick the cornerstone out and the pyramid will not topple, but organisms on the upper levels will suffer if that cornerstone is the key to their survival. Kick enough blocks out of the bottom levels and the foundation will fail, the pyramid will tumble and the ecosystem will collapse. In either case, man will ultimately suffer the loss.

We see now that the real machinery of ecosystems, particularly aquatic ecosystems, is run by masses of faceless, unknown and largely unappreciated workers. Perhaps Aldo Leopold had these obscure organisms in mind years ago when he wrote: "American conservation is, I fear, still concerned for the most part with showpieces. We have not yet learned to think in terms of cogs and wheels. . . . We need knowledge—public awareness—of the small cogs and wheels. . . ." Unfortunately, there is a world of cogs and wheels still unthought of.

There is a moral side, too. Man is presumably the most intelligent and compassionate creature on earth (although I will be the first to admit considerable doubt on both counts). In this esteemed and lofty position, man assumes an ethical responsibility as guardian of all lesser organisms (except, perhaps, for those organisms that threaten his existence, such as the bubonic plague bacterium). Each form of life, whether a species of diatom or the whooping crane, is unique, never again to be duplicated along the road of evolution. Once it is gone, it is gone forever. Naturalist John Muir put it this way: ". . . the universe would be incomplete without man; but it would also be incomplete without the smallest transmicroscopic creature that dwells beyond our conceitful eyes and knowledge."

We share this world with a multitude of creatures. The larger, more familiar inhabitants have common names, like robin or ponderosa pine. But the vast majority of life forms on earth are known only by their Latin or scientific names and only to a small handful of specialists. They have no defenders, no laws or regulations or groups organized to protect them. They have no lobbyists in Washington or Helena, no special teams to study them, no governmental agencies charged with managing and perpetuating their existence.

At a time when we are probing the mysteries of distant planets, it is ironic that we know so little about life on our own. We are apparently complacent in our knowledge of a few showpieces, while ignorant of the status of whole groups of lesser—though perhaps more functional—organisms. How many small and unprotesting creatures have we bulldozed, draglined, blasted, drained, flooded or poisoned into oblivion? How many more are on the brink? We simply do not know.

Environmental impact statements often reassure the reader that "no adverse effects on the environment" are anticipated. Whenever I read a line like this, I pause to consider how little we know about the small nuts and bolts that hold our ecosystems together. Impacts are usually gauged by people's sensitivities or what will happen to a few select organisms prized by people; lesser organisms are often ignored. Until we have knowledge of the distribution, abundance and tolerances of our smaller cohorts on this earth, any decisions about these creatures will be decisions founded on ignorance.

Yes, there is magic in water—magic in its creative potential and in the almost endless variety of creatures that we left behind so many millions of years ago. Even as adults, we are attracted to water, just as small children are drawn to a wading pool. We are all children of water. Whether we gaze across the expanse of Flathead Lake, float the Missouri River or simply cup our hands for a cool drink from a mountain spring, it is not without a vague sense of reunion, a feeling of coming home. ■

photo Harry Engels

THE STILLNESS OF JANUARY

Among other things, winter is stillness. Especially January winter, when the purity of the cold whiteness signals the start of a new, unmarked year.

But each season has its own special flavor—the shifts of climate, the progression of living things—that makes it different, worth savoring. A chance meeting in late March with a glacier lily as it pushes against its crusty, snowy cap. Or an August encounter with a muskrat, as you enjoy a summer ramble through the marshy country.

Mark such events with the 1980 *Montana Outdoors* Wildlife Calendar. For each personal or gift order, send $4 to: *Montana Outdoors*, Department of Fish, Wildlife and Parks; Helena, MT 59601.

The Riddle of Existence:

Our Smaller Cohorts

by Loren Bahls

WATCHING MY two little boys frolic in their wading pool last summer, I recalled a line by the late naturalist Loren Eiseley: "If there is magic on the planet, it is contained in water." It must be true, I thought. After all, who knows more about magic than children?

To Eiseley, water contained magic because it was the medium for life's origin. Life on earth had its mysterious beginnings in the fertile seas of distant Pre-Cambrian times. As recently as 100 years ago, respected scientists believed that life was still being created anew in the depths of the oceans, an intriguing notion occasionally rekindled today by accounts of some new life form dredged up from the bottom of the sea: "Giant 'Worms' Found on Sea Floor" read one newspaper headline not long ago.

Our roots go deep. Sea water flows in the veins of my children, as it does in your veins and mine. Our bones are made of carbonate of lime. Eons ago, wearing a skin shed many times since, man took leave of the warm, green seas and stumbled awkwardly ashore on scaly appendages, gasping and blinking. At that moment, we left the realm of water—the mother element. More significantly, we parted company with nine-tenths of all living things on earth.

Today in Montana, descendants of our distant sea-dwelling ancestors live on, various and abundant, in our lakes and streams. They have changed little over the millennia. Remnant populations of marine algae inhabit saline seeps in Chouteau County. Fresh-water sponges thrive in bogs straddling the Continental Divide. Primitive armored shrimps burrow in the sun-drenched gumbo of prairie swales in the Big Dry, and jellyfishlike hydras wave their tentacles in beaver ponds at the foot of the Beartooth Mountains.

Most people are unaware these living anachronisms exist. Save for the scientist working alone at his microscope in some secluded laboratory, we have lost touch with all but the largest and most familiar aquatic creatures. To most of us, the great majority of living things in Montana—those of the water world—remain out of sight and out of mind.

When biologists gather to talk about rare, extinct or endangered species, chances are the topic of conversation is a creature with fins, fur or feathers, large enough to be seen with the unaided eye and with an easily recognizable name. Yet for every creature we *know* to be extinct or in trouble, scores exist—maybe hundreds—about which we know next to nothing. Let me take you to a scenic valley in northwestern Montana and show you what I mean.

Serenely and without fanfare, Lake Creek meanders out of the north end of Bull Lake to begin its short descent to the Kootenai River near the town of Troy. Tepid in summer, ice cold in winter, now placid, now quick, Lake Creek is an ecological chameleon—a stream for all seasons. Before it gains momentum, it receives a major tributary of opposite personality. In a setting appropriate for a Brahms symphony, Stanley Creek begins as a cold spring in the cathedral hush of a cedar forest deep in the flank of stoic Mount Vernon. Where Lake Creek is moody, hot-blooded and temperamental, Stanley Creek is cool-headed, reliable, constant.

Together, this odd couple fosters what may be the most diverse community of aquatic plants and animals in Montana. Some members of the community are obvious, like fish and the aquatic "weeds" that take root in quiet backwaters. But the great majority will be revealed only if you stoop to turn over a sunken log or examine a rock scraping under a microscope.

In 1977, a team of scientists converged on the Lake Creek Valley to inventory its resources and to predict the

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impacts of the forthcoming ASARCO Inc. mining and milling complex. As a member of that team, I soon discovered that practically nothing was known about aquatic life in the valley. In other parts of Montana, I have learned this is the rule rather than the exception, especially in areas removed from university and college campuses. What we found here was more or less typical of other unstudied aquatic ecosystems across the state.

We found that the Stanley Creek-Lake Creek system harbors at least 82 kinds of small, spineless animals called "macroinvertebrates." Most of these fish food organisms are insects in immature stages. I say "at least 82 kinds" because it is practicable to identify many macroinvertebrates only to the genus level and each genus contains one or more species. How many species of aquatic insects exist in Montana? No one knows for sure, but Dr. George Roemhild of Montana State University of Bozeman, a specialist in this area, guesses there are "somewhere between 1,500 and 2,000."

Moving down the food chain, we come to the microscopic aquatic plants or algae. Basically, there are two kinds of fresh-water algae: diatoms, and all the rest. Diatoms are single-celled algae that live in ornately decorated glasslike cases attached to the bottom of the stream. (Although it is impossible to see a single diatom with the naked eye, they are collectively the most important group of plants in our rivers and streams. If you have ever slipped on the slimy substance covering a rocky streambed, you have encountered diatoms *en masse*.) Algae represent the first link of the aquatic food chain leading to fish and fish-eating birds and animals.

At least 38 different kinds of nondiatom algae and 330 kinds of diatoms live in Lake and Stanley creeks. What is more astonishing, 31 of these diatoms were unrecorded in Montana before the study, and another 37 kinds could not be identified with available references or matched with species known to occur in the state. This means that these 37 diatoms are either new to science or, at least, new to Montana.

How many kinds of algae are there in Montana? Again, nobody knows for sure. A recent checklist of Montana algae by Drs. G. W. Prescott and G. E. Dillard listed 1,758 species, yet only a small portion of the state has been seriously surveyed and previously unrecorded species are showing up in every newly inspected area. (This is also true of the macroinvertebrates. East of a line between Great Falls and Livingston, you can count the number of published algal or macroinvertebrate surveys on the fingers of one hand.) Ultimately, there may be as many as 3,000 species of algae in Montana, about half of them diatoms.

Our running total is now at least 450 kinds of plants and animals for the Stanley-Lake creeks ecosystem. And this does not even include the flowering aquatic plants, mosses and liverworts, beneficial bacteria and fungi, crustaceans, leeches, mites, snails, clams, nematodes, rotifers and protozoans, none of which was included in the survey. Easily, well over 500 different species of life are nourished by these two small streams. And probably 10% of these had not been known in Montana before this modest baseline inventory.

All very interesting, you might say, but so what?

When we talk about extinct, rare or endangered species in Montana, we are talking about animal and plant groups that comprise only a very small percentage of the state's fauna and flora. So little is known of the remaining groups that the status of many species remains in doubt. For these, there is simply too much uncharted territory in Montana—too many holes in the available information—to make any concrete statements about distribution and abundance.

But, you might add, why worry about these little creatures? Who's going to miss one or two, or even a dozen? If some drop out of sight, plenty of others will take their places. So why the fuss?

Such questions demand consideration—both practical and moral. First the practical.

Imagine a community of plants and animals as a pyramid, with the larger, more familiar organisms near the top and the smaller, more obscure ones—like algae and macroinvertebrates—near the bottom. Suppose also that each level of blocks in the pyramid depends on the next lower level for subsistence and that the width of each level is proportionate both to the number of species and the number of individual organisms in that level. In this man-centered world, it is only logical to put man himself at the pyramid's apex.

With such a model, two things are immediately evident: First, the forms of life most prized by man and familiar to him (e.g., cutthroat trout and bald eagles) are relatively few in number and variety and occupy a

continued on page 10

"Every living thing on earth is unique. Once gone, it can never be replaced. It is part of what scientists call our 'genetic pool'—the great reservoir of life on earth. Evolution, and unknown combinations and mutations of genes within that reservoir will certainly produce forms of life in ages to come that we cannot know about today. As passengers on this spaceship Earth, we'd be foolish to wipe out any of our shipmates. They will at least make our voyage less lonely as we drift through the endless, lifeless reaches of space—and they probably will make us wiser and better, as well. Many years ago, a naturalist named William Beebe wrote:

> **The beauty and genius of a work of art may be reconceived, harmony may yet again inspire the composer, but when the last individual of a race of living things breathes no more, another heaven and another earth must pass before such a one can be again."**

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The Riddle of Existence:

Montana's "Rare Plants"

by Robert Gale

THE U.S. FOREST SERVICE (FS) is identifying "rare plants" in Montana's 10 national forests for protection under provisions of the Endangered Species Act.

Edward R. Schneegas, FS Northern Region director of wildlife and fisheries, is coordinating the program. "Following passage of the legislation for the protection of threatened and endangered species of plants and animals," Schneegas explained, "the Smithsonian Institution was directed to prepare a list of U.S. plant species thought to be in danger of extinction in the foreseeable future."

In 1975, the Smithsonian submitted a list of 2,099 species suspected of being threatened or endangered. This compilation (published in the Federal Register July 1, 1975) included 10 plant species found in Montana:

1. *Silene spaldingii* (no common name)
2. *Phlox missoulensis* (Missoula phlox)
3. *Grindelia howellii* (Howell's gumweed)
4. *Cryptantha soblifera* (no common name)
5. *Cardamine rupicola* (Cliff toothwort)
6. *Draba apiculata* var. *daviesiae* (no common name)
7. *Rorippa calycina* (no common name)
8. *Claytonia flava* (no common name)
9. *Aquilegia jonesii* (Limestone columbine)
10. *Penstemon lemhiensis* (Lemhi penstemon)

The Smithsonian classified *Silene spaldingii* and *Phlox missoulensis* as potentially endangered and the other eight were listed as potentially threatened. Since most of these plants are ordinarily somewhat rare, they have no generally accepted common names.

The Office of Endangered Species of the U.S. Fish and Wildlife Service (FWS) bears responsibility for officially designating appropriate species as threatened or endangered. That office analyzed the 1975 Smithsonian list and solicited comments from the scientific community and private individuals; the FWS subsequently proposed three plant species for "endangered" classification (Federal Register, June 16, 1976) in Montana: *Phlox missoulensis, Silene spaldingii* and *Trisetum orthochaetum.*

In summer 1977, the FS hired Dr. T. J. Watson, Jr., assistant professor of botany at the University of Montana in Missoula, to conduct a study of plant life in the Montana national forests. The purpose of this study was to locate, record and evaluate those species of Montana flora that appeared on the Smithsonian and FWS lists. (The FWS had added *Trisetum orthochaetum*

Clockwise from upper left: *Penstemon lemhiensis* **(Lemhi penstemon),** *Draba apiculata* **var.** *daviesiae* **(no common name),** *Cardamine rupicola* **(Cliff toothwort),** *Aquilegia jonesii* **(Limestone columbine),** *Grindelia howellii* **(Howell's gumweed),** *Phlox missoulensis* **(Missoula phlox). photos courtesy USDA Forest Service.** Turn the page for a detailed description of each of these six plants.

to the Smithsonian's list.) Dr. Watson recommended that four species in Montana be considered for formal "endangered" classification: *Silene spaldingii, Grindelia howellii, Penstemon lemhiensis* and *Trisetum orthochaetum.* No species were recommended for "threatened" classification. These four should by no means be considered the only Montana flora worthy of statutory protection, Watson's report stated. He further noted they are merely the only species now believed "endangered" or "threatened." The process of evaluating these plants toward possible official "endangered" classification involves a continuing effort by federal and state agencies, universities, private firms and interested individuals.

Schneegas asked that *Montana Outdoors* readers assist with the program: "Should you observe one of Montana's 'rare plants,' please notify the nearest Forest Service office and help us preserve the beauty and uniqueness of our natural heritage."

All national forest visitors are urged to cooperate in protecting and preserving these rare plants by refraining from uprooting them or picking their flowers or fruits. Most of the plants cannot be successfully transplanted into gardens.■

SCIENTIFIC NAME: *Draba apiculata* var. *daviesiae*
COMMON NAME: none
FAMILY: Brassicaceae (Mustard family)

This pretty little mustard is found only in the alpine zone above timber line in the Bitterroot Mountains along the Montana-Idaho border. Here it grows in rock crevices, flowering shortly after the snow melts. Although once thought to be very rare, it is now known to occur on almost every major peak in the Bitterroots. The plants are numerous and easily found by the alpine hiker, but should not be picked—otherwise they too could end up on the endangered list. The plants will not grow outside of their native habitat.

SCIENTIFIC NAME: *Phlox missoulensis*
COMMON NAME: Missoula phlox
FAMILY: Polemoniaceae (Phlox family)

Phlox missoulensis is a small plant found on wind-swept ridges at moderate elevations. This species was once thought to be very rare, but it is now known from 10 sites in western and central Montana. Populations are large, consisting of hundreds to thousands of plants and Missoula phlox does not presently seem to be in danger of extinction. The species is named for the city near which it was first discovered. The flowers, blue or white, appear in early spring.

SCIENTIFIC NAME: *Grindelia howellii*
COMMON NAME: Howell's gumweed
FAMILY: Asteraceae (Sunflower family)

Howell's gumweed was once known from only a single population in north central Idaho, but it has recently been found in western Montana. The population in Idaho seems to have been destroyed, so the species is now located only in Montana. It is found in grassy openings amid forests near the Clearwater River. The plants are threatened by road grading, vehicle travel and weed control programs. Howell's is distinguished from other gumweeds by having pubescent (hairy) stems.

SCIENTIFIC NAME: *Cardamine rupicola*
COMMON NAME: Cliff toothwort
FAMILY: Brassicaceae (Mustard family)

Cliff toothwort grows at high elevations on talus slopes and in crevices of rock cliffs. It is indigenous (native) to Montana, occurring in the Swan, Mission and Flathead mountains. Although the populations are widely separated, individual plants are numerous at each site. The species is protected by the remoteness of its preferred habitat. Cliff toothwort flowers in July and August.

SCIENTIFIC NAME: *Penstemon lemhiensis*
COMMON NAME: Lemhi penstemon
FAMILY: Scrophulariaceae (Figwort family)

Penstemon lemhiensis is a very rare plant of the sagebrush-grasslands in southwestern Montana and adjacent Idaho. In Montana, the species is represented by as few as 400 plants from only seven known sites. These few plants are under intense pressure from grazing, road construction and weed control spraying. The plants depend upon a single species of wasp for pollination, so protection of the plant may also require protection of the insect.

SCIENTIFIC NAME: *Aquilegia jonesii*
COMMON NAME: Limestone columbine
FAMILY: Ranunculaceae (Buttercup family)

This uncommon columbine is a diminutive plant of subalpine habitats, where it occurs on scree slopes of limestone. The species is distributed from southern Alberta to northwestern Wyoming. In Montana, it is often found in the Swan Mountains. The plants can be distinguished from other columbines by the blue flowers, leafless stems and small size (less than 5.85 inches [15 cm] tall). Limestone columbine cannot be successfully transplanted to lowland gardens.

The Riddle of Existence:

Audubon Bighorn Sheep

by Ken Walcheck

IN THE SCIENCE BUILDING at Northern Montana College in Havre, a full mount of an Audubon bighorn sheep stands behind glass, as though poised on a spindly sandstone pinnacle in the Missouri River Breaks. A label explains the Audubon was shot by Hans Lefeldt, south of Big Sandy, during the 1890s.

But the label does not tell the story of how the specimen resided for more than 20 years—amid tobacco smoke, spittoons, clanking slot machines and dusty cowboys—in the Honky Tonk Saloon of Havre's old Montana Hotel. Nor does it elaborate on the dedicated efforts by which Lou Hagener, professor of biology at Northern, acquired the specimen for the college. Nor does the label mention that this is one of the few places in the world where an Audubon bighorn sheep can be seen. Yet that is the case, because the Audubon—one distinct race within the bighorn sheep species—is now extinct.

Although bighorn sheep had undoubtedly been observed in eastern Montana before 1800, the first documentation of sheep was made by Joseph Fields of the Lewis and Clark Expedition. He saw bighorns near the mouth of the Yellowstone River (in what is now North Dakota). Meriwether Lewis wrote in his journal that Fields "saw several of the bighorned anamals in the course of his walk; but they were so shy that he could not get a shot at them; he found a large horn of one of these anamals which he brought with him."[1]

In Montana, members of the expedition first spotted bighorn sheep near Culbertson. On April 29, 1805, William Clark wrote:

> had not proceeded far eer we Saw a female & her faun of the Bighorn Animal on the top of a Bluff lying, the noise we made allarmed them and they came down on the side of the bluff which had but little slope being nearly purpindicular, I directed two men to kill those animals. one went on top and the other man near the water they had two shots at the doe while in motion without effect, Those animals run & Skiped about with great ease on this declivity & appeared to prefur it to the leavel bottom or plain.[2]

That evening, perhaps in the vicinity of Big Muddy Creek, Clark saw several of the "bighorned anamals."

Lewis and Clark had some prior knowledge of the "kind of anamale with circular horns" they would encounter on their westward journey. During the winter of 1804-05 at Fort Mandan, N.D., they obtained information from the Indians about this species. On Dec. 22, 1804, Clark wrote:

> We precured two horns of the anamals the french Call the Rock Mountain Sheep. those horns are not of the largest kind. The Mandans Call this Sheep, Ar-Sar-ta it is about the size of a large Deer, or a small Elk, its Horns Come out and wind around the head like the horn of a Ram, and the texture is not unlike it, much larger and thicker perticelarly that part with which they butt."[3]

That both Lewis and Clark were keen-eyed observers and objective biological reporters is evident from an examination of their notes on bighorn sheep. The journals show 27 specific entries, including a remarkably detailed description of a bighorn sheep killed above the mouth of the Musselshell River. Eighteen of the entries were made east of the Marias River, in country characterized by towering sandstone and shale cliffs, deep coulees, ravines and rugged hills. The remaining entries were made in the mountainous regions of western Montana.

As an admirer of Lewis' ability as a naturalist, I often wonder if he entertained thoughts on how the forces of geology, climate and evolution affected distribution of animals such as the bighorn sheep. Did he ever question why the "Argalia," as he sometimes called the bighorn, was limited only to the rugged badlands and mountainous terrain of the western portion of the Louisiana Purchase?

Lewis no doubt would have listened attentively if he could have heard the theories advanced by future scientists on the evolution of mountain sheep and the speculations about their origin in the mountains of central Asia, western Mongolia and Tibet some 2½ million years ago. He would have been intrigued to learn how the interplay of two powerful, dynamic agents—the environment and the evolution of the species—caused the movement and distribution of bighorns around the Northern Hemisphere to most mountain ranges in Europe, North Africa and Asia.

What would he have thought if he could have heard the fascinating story later fossil finds would reveal of bighorn sheep crossing to the Western Hemisphere via a land bridge from Asia during the ice age? Since that crossing of the Bering land bridge, they have further evolved into two distinct North American species, as classified by Ian M. Cowan, an authority on mountain sheep: *Ovis dalli* (thinhorn sheep) and *Ovis canadensis*

(bighorn sheep).[4] Cowan theorized that when the great glaciers of the ice age inched south from polar centers, mountain sheep became isolated in two ice-free areas (or refugia), one in central Alaska and the other south of the Columbia and Snake rivers in the United States. Sheep confined to the Alaska-Yukon refugium evolved into the slender-horned Dall sheep, while those farther south evolved into the heavy-horned Rocky Mountain bighorns.

The bighorn species comprises seven living races (forms not different enough to be judged distinct species), plus the extinct "badlands" or Audubon bighorn sheep, *Ovis canadensis auduboni*—named in honor of John James Audubon, the renowned naturalist who traveled up the Missouri River to Montana's eastern border in 1843. Some disagreement still stands, however, as to whether the Audubon should be classified as a distinct race.

Anyone observing North American mountain sheep is struck both by the resemblances and differences among the races. The intellectual desire to "pigeonhole" diverse objects into a systematic order leads the observer to classify animals found in different geographical locations, but of the same general appearance, together and to give them a collective name—such as desert, Rocky Mountain or California bighorns.

The answer to whether the Audubon bighorn sheep should be classified as a separate race depends on the answers to some other questions: What is a species, and what constitutes a geographic race? Since Charles Darwin's publications more than 100 years ago, the species concept has undergone two fundamental changes. First, through evolution, one species arises from another pre-existing species. Therefore, animals related through evolutionary descent should show "family resemblances," and indeed they do. Second, a species is no longer defined as a certain type of organism with a precisely defined shape, size and color. Instead, it is now defined as a living population, with about the same structure, size, color, behavior and habitat, and breeding with each other rather than with members of other similar groups.

Species—the kind of animal—is usually the smallest systematic unit recognized in zoological field work. But specialists working closely with many individuals of the same species from different parts of the species' range are often able to sort them into geographic groups—eastern, western, southern, desert, coastal—and designate them as geographic races. These races may differ only in superficial characteristics, such as size or intensity of color, but are still capable of interbreeding with each other. To nonscientists, the minor distinctions that separate races may seem negligible and, in some cases, less significant than the more dramatic physical differences between individuals of a single race.

In the case of the Audubon and Rocky Mountain races, both appear practically identical and any external differences would be difficult to detect for even the trained eye. I recall walking on many occasions past a full mount of a bighorn ram formerly displayed in the front window of the Montana Bar in Miles City and I never realized it was an Audubon sheep.

It was similar to the Rocky Mountain race in all respects. Even Meriwether Lewis, whose journal writings bulge with evidence of his skill in reporting wildlife characteristics, made no reference to any morphological distinctions—such as color, size or shape of horn—between sheep observed in the eastern or central part of the state and those found in the western portion.

The problem of distinguishing between the two separate races is especially difficult when one of those races has become extinct. Often then the taxonomist must work—as in the case of the Audubon sheep—from a few museum specimens. He can therefore use only external physical characteristics to describe and delineate a race, since more sophisticated laboratory techniques are impossible with museum specimens. Such superficial comparisons are often unreliable as criteria of relationship.

Many Montanans who have heard of the Audubon bighorn sheep believe it was strikingly different in appearance from *O.c. canadensis*, the Rocky Mountain race native to western Montana. Comments that the Audubon sheep was "more graceful," "more delicate in stature" or marked by "flaring argali-type horns" have perpetuated this erroneous belief.

The various factors responsible for extinction of the Audubon sheep were related, in a complex way still not fully understood. Undoubtedly, man played the chief role.

This was dramatized to me recently while I was persuading the new proprietor of the Montana Bar that the full mount of an Audubon sheep which she had taken out of the window and stashed away in a storeroom would be better displayed at the department's regional office in Miles City. I talked with one of her employees about Audubon sheep and mentioned that this kind of bighorn once lived in eastern Montana, but was now extinct. The word "extinct" seemed to spark her imagination and she told me, "It's easy to see the difference between the horns of the Audubon and the Rocky Mountain bighorn sheep." Anyone not familiar with the variation that normally exists in sheep horns might easily reach such a conclusion.

The Swiss artist, Karl Bodmer, unknowingly also played a role in creating an exaggerated image of some of Montana's wildlife, including the Audubon sheep. During the summer of 1833, Bodmer traveled up the Missouri River with his German patron, Prince Maximilian of Wied. Maximilian was an experienced naturalist and Bodmer complemented his patron's scientific endeavors by capturing the sweeping vistas of the upper Missouri and its wildlife, including bighorn sheep. Bodmer's work gave the outside world its first look at what would be Montana and some of the species that lived there.

Bodmer's painting, "The Stone Walls on the Upper Missouri," was sketched near Eagle Creek and shows a band of bighorns resting beneath a formation of sandstone parapets. Although Bodmer brushed some characteristics of Austria's wildlife into the bighorn's appear-

A full-mount Audubon bighorn sheep displayed as part of the wild animal collection at the Valley County Pioneer Museum in Glasgow (DFWP photo: Mike Aderhold).

ance, the painting still leaves an indelible impression in many minds as to what the "real" Audubon or badlands sheep looked like.

The only systematic attempt to identify specific racial characteristics of the Audubon sheep was made by Cowan. He determined there was a statistically significant difference between the races *auduboni* and *canadensis*, based on size differences among certain skull bones. He found no differences between the horns of the two races. Cowan wrote:

> *O.c. auduboni* based as it is on slight cranial characters presented by a small number of specimens [7] is to be recorded as a weak race. The indications are however that the characteristics exhibited by these individuals are not the result of chance and that sheep so characterized inhabited a definite range in the badlands to the east of the Rocky Mountains. The absence of identifiable material from eastern Wyoming and eastern Montana renders it impossible to determine the area of contact between *auduboni* and *canadensis*."[5]

Some observers contend that the Audubon sheep was lighter in color than the Rocky Mountain race, but information on this subject is minimal. Cowan described the Audubon as "probably somewhat paler than *O.c. canadensis*."[6] In "Extinct and Vanishing Mammals of the Western Hemisphere," Glover M. Allen described it as "very slightly different from *canadensis* [with] light grayish-brown coat. Rump and under parts grayish-white."[7]

Whether the Audubon can be truly classified as a distinct, separate race is a moot point: There is simply not enough evidence to make a case one way or the other. However, one should not completely close the door on the possibility of *auduboni* as a distinct race.

Sheep behaviorist Valerius Geist pointed out that mountain sheep have been very adept in fulfilling the criteria of zoological success, such as a wide geographic distribution, a long period of existence, numerical

strength and ecological fitness.[8] Invasion of new areas by mountain sheep and creation of new races have been well demonstrated in North America. Geist suggests that sheep extend their geographical range only when suitable habitat becomes extensive and that this activity is probably performed by bands of rams roaming in spring. "If an extension of suitable habitat is not present," wrote Geist, "there is a behavioral selection against dispersing juveniles. Consequently, juveniles inherit home ranges from adults and in turn pass them on as a living

AUDUBON SHEEP REPORTED IN MON

AREA	DATE	COMMENTS
Missouri River Breaks (near Culbertson)	April 29, 1805	Observation by William Clark. First documentation of bighorn sheep in Montana by Lewis and Clark Expedition.
Missouri River Breaks (above the mouth of the Musselshell)	May 10, 1805	Meriwether Lewis mentions seeing three of the "bighorned anamals."
Missouri River Breaks (below Cow Creek)	May 25, 1805	Observation by Lewis and others. Three bighorns killed which provided the first detailed description of bighorn sheep. A lengthy description of the Audubon sheep is given by Lewis in the journals.
Missouri River Breaks (near Cow Creek)	May 26, 1805	Clark observed several herds of bighorns; two bighorns were killed.
Missouri River Breaks (above Cow Creek)	May 27, 1805	Lewis comments on seeing a few small herds of bighorns.
Missouri River Breaks (vicinity of Dog Creek)	May 28, 1805	Lewis comments that "the bighorn is in great quantities."
Missouri River Breaks (Judith River)	May 29, 1805	Lewis comments on the ". . . great abundance of the Argalia or bighorned animal in the high country through which it [Judith River] passes. . . ."
Missouri River Breaks (above Arrow Creek)	May 31, 1805	Lewis mentions two bighorns taken.
Missouri River Breaks (vicinity of Little Sandy Creek)	June 1, 1805	Lewis mentions one bighorn taken.
Yellowstone River Breaks (vicinity of Pompey's Pillar)	July 25, 1806	Mention of bighorn sheep by Clark, of which he shot two.
Yellowstone River Breaks (vicinity of Bighorn River)	July 26, 1806	Mention of bighorn sheep by Clark.
Missouri River Breaks (vicinity of Arrow Creek)	July 29, 1806	Observation of bighorns by Lewis and others; nine bighorns killed.
Missouri River Breaks (near Cow Creek)	July 30, 1806	Observation of bighorns by Lewis and others; nine bighorns killed.
Missouri River Breaks (below Cow Creek)	July 31, 1806	Lewis mentions two bighorns taken.
Yellowstone River (near Fairview)	August 2, 1806	Clark mentions seeing bighorns.
Missouri River Breaks (near mouth of Yellowstone)	August 3, 1806	Observation by Clark; one bighorn killed.
Missouri River Breaks (vicinity of Fort Union)	June 28-July 3, 1843	Two ewes observed by J. J. Audubon.
Little Wolf Mts. (south of Colstrip)	1851	Observation by Father P. J. DeSmet during his trip up the Rosebud: "We perceived at every moment large troops of stags, and a great many deer and mountain sheep."
Missouri River Breaks (just below the Musselshell River)	1870	Peter Koch wintered in the Missouri Breaks, just below the Musselshell, cutting wood for steamboats and wolfing. Koch reported killing one sheep.
Yellowstone Breaks (Big and Little Porcupine creeks)	about 1880	Bighorn sheep observed by H. F. Schlosser, Miles City.
Blue Mts. (near Locate)	1883	One bighorn killed by H. F. Schlosser, Miles City.
Bearpaw Mts. (south of Havre)	1885	Edward L. Munson, assistant surgeon in the U.S. Army, reported that Bearpaw Mts. were full of bighorn sheep about 1885 and that they were destroyed by anthrax brought in by domestic sheep.

tradition to the next generation."[9] In a restless world of heaving earthquakes, wandering shorelines, shifting climates and changing vegetation, one can scarcely expect to have sedentary tenants. A mountain sheep's geographic range was not likely to stand firm before a grinding, 2,000-foot wall of ice.

It seems quite possible that the Aubudon bighorn sheep developed as an offshoot from the Rocky Mountain bighorn, some time before the last ice age, in the mountains of western Montana. Development of the

continued on page 36

'ANA—A PARTIAL DOCUMENTATION

AREA	DATE	COMMENTS
Blue Mts. (near Knowlton)	1893	Twenty-four bighorns observed by Dan Bowman, Miles City. Bowman killed a ram in this area and the head is in the Carter County Museum, Ekalaka.
Bull Mts. (head of Fattig Creek)	1890	A questionable documentation of 50 bighorns as reported in Kenneth Thompson's 1950 manuscript.
Powder River Breaks	1890s	Dan Bowman of Miles City reported bighorns from the mouth of the Yellowstone River to the Little Powder River.
Glendive Badlands	1894	Eighteen bighorns observed by Andrew Larson of Glendive.
Glendive Badlands	late 1890s	Twenty-six bighorns observed by Ray Lowe of Glendive.
Alkali-Teepee creeks (Carter County)	1898	Twenty-two bighorns observed by W. H. Peck of Ekalaka.
Chalk Buttes (Carter County)	1898	Three bighorns observed by W. H. Peck of Ekalaka.
Sheep Mts. (Carter County)	1898	Bighorns observed by W. H. Peck of Ekalaka.
Missouri River Breaks (south of Big Sandy)	1890s	Hans Lefeldt killed one ram on Eight Mile Ridge. The Audubon bighorn is presently on display at Northern Montana College in Havre.
Missouri River Breaks (vicinity or Hell and Seven Blackfoot creeks)	early 1900s	H. Cosner of Malta described bighorn sheep in this area as being abundant.
Missouri River Breaks (Snow Creek)	1905	V. C. Hooker of Baker observed 20-30 bighorns in this area.
Missouri River Breaks (Hell Creek area)	1908 or 1909	One bighorn ram killed by Arthur Jordan. This sheep is presently on display at the Miles City Fish, Wildlife and Parks office.
Missouri River Breaks (vicinity of the Judith River)	1909	Homesteader Dave Osborn reported seeing a herd of 10 bighorns.
Missouri River Breaks (Snow Creek)	1910	One ram killed by Dr. David A. Baker, as reported by Myrtle Burke of Glendive.
Larb Hills (south of Saco)	before 1912	One bighorn sheep killed by Alec Doney; possibly the last sheep taken in Larb Hills.
Missouri River Breaks (Seven Blackfoot Creek)	1912	One bighorn sheep killed by William Tressler.
Missouri River Breaks (south of the Little Rockies)	1912	Ten bighorns observed by Harry Green of Big Sandy.
Larb Hills	1914	One bighorn reported killed.
Missouri River Breaks (Billy Creek-Seven Blackfoot Creek area)	1915	George Donaldson of Jordan killed a bighorn ram in the Billy Creek-Seven Blackfoot Creek area. The Audubon head is presently in the possession of Marlowe Ewy and will be placed in the Jordan Museum.
Misssouri River Breaks (Seven Blackfoot Creek area)	April 14,1916	According to Glen Childers of Brusett, Dr. David A. Baker of Jordan, guided by Ben Wilson, reportedly killed the last of the Audubon sheep. Dr. Baker, according to Childers, was at the Wilson ranch delivering a baby and this is why the April 14 date is remembered.
Spring Creek (Carter County)	——	One pair of bighorn horn cores found. Reported by M. E. Lambert of Ekalaka.
Tie Creek (Carter County)	——	One pair of bighorn horn cores found. Reported by M. E. Lambert.
Birney (Rosebud County)	——	Two bighorn sheep skulls in possession of Bunny Hayes, Birney.
Cook Creek (Rosebud County)	——	One bighorn skull reported by Bunny Hayes.
Maxwell Butte (vicinity of Powderville)	——	One pair of sheep horns found in 1914, now in possession of Don Pyle of Miles City.
Chalk Buttes (Carter County)	——	One bighorn sheep skull collected by Odis Harkins of Ekalaka.

"PASSENGER PIGEONS? In Montana?" he scoffed. "Surely you're kidding."

I quickly assured my former ornithology student that I was serious: From the time of Lewis and Clark and for 70 years afterward, there were recorded sightings in Montana of this famous vanished creature.

The vast migratory flocks of passenger pigeons were one of the greatest wonders of the early American natural world. Its name derives from the dense masses of birds that once darkened the sky, crossing overhead like interminable passing railroad trains upon which the individual pigeons seemed to be carried as passengers. *Ectopistes migratorius* to scientists, the passenger pigeon was known also, because of its speed, grace and agility, as the "blue meteor." Its migratory flights, roostings, nestings and enormous numbers were so spectacular that it attracted the notice of many explorers and writers. In 1832, Alexander Wilson, known by some as the "Father of Ornithology," was traveling through Kentucky when he suddenly heard a loud rushing roar, followed by instant darkness. Wilson later recounted:

> Coming to an opening by the side of a creek called the Benson, where I had a more uninterrupted view, I was astonished at their appearance. They were flying with great steadiness and rapidly, at a height beyond gunshot, in several strata deep, and so close together, that could a shot have reached them, one discharge could not have failed of bringing down several individuals. From right to left as far as the eye could reach, the breadth of this vast procession extended, seeming everywhere equally crowded.... It was then half past one. I sat for more than an hour, but instead of diminution of this prodigious procession, it seemed rather to increase both in numbers and rapidity; and, anxious to reach Frankfort before night, I rose and went on. About four o'clock in the afternoon I crossed the Kentucky River, at the town of Frankfort, at which time the living torrent above my head seemed as numerous and as extensive as ever. Long after this I observed them, in large bodies that continued to pass for six or eight minutes, and these again were followed by other detached bodies, all moving in the same south-east direction, till after six in the evening.[1]

Wilson had observed a living river of passenger pigeons, a mass of feathered projectiles that—by his calculations—contained more than 2 billion pigeons, was a mile wide and stretched for 240 miles. The total population of this species at this time in the forested eastern half of the United States has been estimated by some authorities to have been between 3 billion and 5 billion birds.[2] That's a mind boggling figure to comprehend, especially when compared with the total bird population of North America which was estimated in 1966 at about 20 billion birds.[3]

Today, the passenger pigeon is extinct. About 1900 it disappeared in the wild state, and in 1914 the last known passenger pigeon died in captivity, at the Cincinnati Zoological Gardens.

In its best days, the passenger pigeon had an extensive range and, according to the "Check-list of North American Birds" (fourth edition), it bred throughout central and eastern Canada and "south to Kansas, Mississippi, Kentucky, Pennsylvania and New York. Wintered principally from Arkansas and North Carolina south to central Texas, Louisiana, and Florida. Casual

The Riddle of Existence:

The Passenger Pigeon

by Ken Walcheck

graphics: © Liz Carmichael Jones
Georgia Dept. of Natural Resources

west to Oregon, Nevada, Washington, and eastern Mexico; accidental in Bermuda, Cuba, the British Isles, and Europe."

Although there are no authentications for Oregon and Washington, Montana is credited with 14 reports of passenger pigeons during the 1880s. The American Ornithologist Union's checklist cites Montana as the northwestern limit of the bird's breeding range. Yet it is more probable that Montana fell outside the general breeding range, and those passenger pigeons observed were merely stragglers or post-breeding wanderers.

Dr. P. D. Skaar, professor of biology at Montana State University in Bozeman, made a meticulous exploration for passenger pigeon documentations in Montana's historical archives and found insufficient evidence to substantiate any Montana nesting.[4] Skaar based his conclusion partly on the fact that many of the early settlers did not reach Montana until midsummer, when breeding and nesting would have already been completed. Furthermore, Montana was well outside the range of mast foods (acorns, beechnuts and chestnuts) that nestling passenger pigeons utilized.

The earliest documentations of passenger pigeons in what is now Montana come from Lewis and Clark. The explorers made eight such notations in their diaries. One entry, dated July 13, 1805, near the mouth of the Sun River, reveals that Meriwether Lewis—unlike some early observers—did not make the mistake of confusing the passenger pigeon with the mourning (or turtle) dove: "I saw a number of turtle doves and some pigeons today. of the latter I shot one; they are the same common to the United States, or the wild pigeon as they are called."[5] Captain Lewis was less accurate when he noted in his July 5, 1806 entry made near Missoula "a great number of pigeons breeding in this part of the mountains."[6] By that time of year, passenger pigeons would have been well past the breeding period.

We are not certain that all of the Montana sightings are accurate and reliable. A distinct possibility exists that some of the early Montana records referred to mourning doves, *Zenaidura macroura*, a species often mistaken for the passenger pigeon.

For example, William Brewster, an experienced pigeoner, wrote of his difficulties:

> I have often been unable to satisfy myself respecting the identity of single birds viewed at a distance, or in unfavorable lights. For a dove seen through mist-laden atmosphere sometimes looked as big as a pigeon, and when its colour and markings could not be discerned it might easily be mistaken for one, there being really no very obvious points of difference between the two birds in respect to either general appearance or behavior.[7]

Arthur Cleveland Bent, author of "Life Histories of North American Gallinaceous Birds," cites an example of a "positive" identification in 1912:

> Dr. C. F. Hodge, who had charge of the offer of $1,000 for the location of a nesting pair of passenger pigeons, received a letter from a man in Maine that he had shot a bird "that proved to be a passenger pigeon," and that he had it mounted. Dr. Hodge sent him descriptions and colored plates of the passenger pigeons and mourning dove, and he underscored in red ink the comparative lengths of those two birds, and he asked the man if, after study of these, he still thought the bird a passenger pigeon to send it to him. The specimen arrived and proved to be a mourning dove.[8]

Also, most observers were frugal in their comments about passenger pigeons and failed to include information on relative numbers, foods, behavioral traits and other items of interest.

Passenger pigeons customarily lived under conditions that would constitute a bedlam of psychological stress for most forms of wildlife. The essence of passenger pigeon ecology was gregariousness. Because mast crop production fluctuated from one year to the next, these birds evolved a mob strategy, a hit-and-run use of breeding areas. Highly mobile, they coped with food exhaustion, pollution, disease and other habitat limitations by simply flying off, *en masse*, to a new and fresh habitat.

John James Audubon, the renowned ornithologist, vividly described such mob-type roosting at a site in Kentucky:

> It was, as is always the case, in a portion of the forest where the trees were of great magnitude, and where there was little underwood. I rode through it upwards of forty miles, and, crossing it in different parts, found its average breadth to be rather more than three miles. . . . The dung lay several inches deep, covering the whole extent of the roosting-place. Many trees two feet in diameter, I observed, were broken off at no great distance from the ground, and the branches of many of the largest and tallest had given way as if the forest had been swept by a tornado. Everything proved to me that the number of birds resorting to this part of the forest must be immense beyond conception.

Their astounding gregariousness was further demonstrated to Audubon when the birds returned to the roost:

> . . . the noise which they made, though yet distant, reminded me of a hard gale of sea, passing through the rigging of a close-reefed vessel. As the birds arrived and passed over me, I felt a current of air that surprised me. . . . The pigeons, arriving by thousands, alighted everywhere, one above another, until solid masses were formed on the branches all around. Here and there the perches gave way under the weight with a crash, and, falling to the ground, destroyed hundreds of birds beneath, forcing down the dense group with which every stick was loaded.[9]

The habits of this species should have been well known to a great many people, yet the explanations cited for its extinction are amazingly muddled and contradictory. One of the shortcomings of our modern society is that most of us tend to see only a frame or two from the passenger pigeon film—an arrested moment or so. Most of us focus

graphics: Mel Wolfe
Georgia Dept. of Natural Resources

only on a single facet of a very complex interaction between the ecology of the passenger pigeon and the ecology and economic development of civilized man on the North American continent.

Ecologist I. Lehr Brisbin wrote a remarkably well thought out paper on the ecology of the extinction of the passenger pigeon.[10] He was accurate when he wrote that before one could really theorize on reasons for extinction, specific disciplines such as ornithology, population biology, ecology, sociology, economics and American history had to be considered independently and then integrated.

Various authorities attribute the extinction to: (1) mass catastrophes, such as drownings and disease, (2) destruction of the pigeon's hardwood forest habitat, (3) inherent biological weaknesses of the pigeon and (4) massive overexploitation of the species by man. Probably of greatest importance among these were the pigeon's inherent gregariousness and its treatment by man.

Carrol Henderson, coordinator of the nongame wildlife program for the Minnesota Department of Natural Resources, describes a "pigeon party" that occurred in Chatfield, Minn., in early June 1863. According to Henderson, such "festivals of destruction" provided the social highlight of the year in many communities:

> At Chatfield . . . men, women, and children converged on the nearby woods. Children "made the forests ring with their shouts of merry glee." Men shook the saplings, little boys climbed the trees and women filled their aprons with the young birds. . . . With each passing year the "squabbing celebration" became a bigger event at Chatfield. In 1865, the people from Winona, Rochester, Preston, Troy, Carimona, and Fillmore were invited to the festivities. On the weekend of June 3 and 4, it was estimated that ten thousand squabs [unfledged pigeons] were eaten or carried off. The special feature was the ascent of Isaac Day [a local politician who had split the seams of his trousers on a mast tree squabbing climb]. While he climbed to the top of a nesting tree, crowds cheered, flags waved, and a band played "Yankee Doodle."[11]

During its early evolution, the extreme gregariousness of the passenger pigeon had undoubtedly conferred some selective advantage for survival. But the bird's formula for perpetuation seems to have been: all or none. That very gregariousness, when the passenger pigeon began to be heavily exploited by man, probably contributed to its total defeat. Brisbin suggests that man's sudden and extreme exploitation of the species caused a loss of biological momentum and took the species off guard. Given more time, the passenger pigeon would presumably have been able to adapt to the new pressures against its gregarious habits and evolved sufficient responses, such as nesting in smaller colonies or—like the mourning dove—in scattered pairs. But the settlement boom of 19th century man hit the passenger pigeon like a tornado hitting a kite. And there was no time for successful evolution.

The large flights of pigeons in the East declined during the 1870s and disappeared in the early 1880s. The last documentation for passenger pigeons in Montana was made by George Grinnell in July 1875, somewhere along the Missouri River, between the mouth of the Yellowstone and the mouth of the Musselshell. Grinnell wrote: "Seen in small companies in July along the Missouri River bottom, where it was doubtless breeding."[12] Within 25 years of that sighting, the passenger pigeon had vanished forever from the earth.

Yet the loss, however regrettable, may not have been entirely in vain, for the passing of a bird known to millions of Americans should serve as a spur to the ecological conscience of our later generations, and as a poignant reminder that man's future is inextricably linked to the fate of all other creatures on this planet.

Nobody could say it better than Aldo Leopold who, more than a quarter-century ago, wrote a perceptive essay reflecting on the extinction of the passenger pigeon:

> There will always be pigeons in books and in museums, but these are effigies and images, dead to all hardships and to all delights. Book-pigeons cannot dive out of a cloud to make the deer run for cover, or clap their wings in thun-

PASSENGER PIGEON RECORDS IN MONTANA (compiled by P. D. Skaar)

1. July 12, 1805. At "Canoe Camp" (7½ miles below the Smith River on the Missouri River). Clark: "a fiew wild pigions about our camp." Reference: Thwaites, Reuben Gold, editor, "Original Journals of the Lewis and Clark Expedition, 1804-06," (eight volumes), Dodd, Mead & Co., New York, 1904-05.
2. July 12, 1805. Between "Canoe Camp" and Whitebear Islands (the latter three miles above the Sun River) on the Missouri River. Gass: "In our way we passed a small bottom on the north side of the river. . . . Here we saw some wild pidgeons and turtle doves." Reference: Gass, Patrick A., David McKeehan, editor, "A Journal of the Voyages and Travels . . . of Capt. Lewis and Capt. Clark of the Army of the United States," Ross and Haines, Minneapolis, 1958.
3. July 13, 1805. Between "Canoe Camp" and Whitebear Islands on the Missouri River. Lewis: "I saw a number of turtle doves and some pigeons today. of the latter I shot one; they are the same common to the United States, or the wild pigeon as they are called." Reference: Thwaites, *op. cit.*
4. July 5, 1806. Blackfoot River between Bonner and Cottonwood. Lewis: "a great number of pigeons breeding in this part of the mountains." Reference: Thwaites, *op. cit.*
5. July 12, 1806. Whitebear Islands (three miles above the Sun River on the Missouri River). Lewis: "saw the brown thrush, pigeons, doves, &c." Reference: Thwaites, *op. cit.*
6. July 19, 1806. Marias River, south of Shelby. Lewis: ". . . also gees, pigeons, doves, hawks, ravens, crows, larks sparrows &c. the Curlooe has disappeared." Reference: Thwaites, *op. cit.*

? July 21, 1806. Near Laurel, on the Yellowstone River. Clark: "Saw . . . Since I arrived at this Camp also . . . pigions, Dovs, Hawks, ravins, crows, larks, Sparrows, Eagles & bank martins &c. &c." Thwaites, *op. cit.*

7. July 24, 1806. At "Camp Disappointment," 10 miles north of the Blackfoot River. Lewis: ". . . a few pigeons that we were fortunate enough to kill. . . ." Reference: Thwaites, *op. cit.*
8. July 25, 1806. At "Camp Disappointment." Lewis: "R. Fields and myself killed nine pige(ons) which lit in the trees near our camp on these we dined." Reference: Thwaites, *op. cit.*
9. July 10, 1833. Near Poplar, on the Missouri River. Prince Maximilian: ". . . many wild pigeons." Reference: Maximilian, Prince von Wied, "Travels in the Interior of North America, 1832-34" (Vols. 22-25 of "Early Western Travels," edited by R. G. Thwaites), Arthur H. Clark Co., Cleveland, 1906.
10. Aug. 30, 1853. Near Havre. Suckley: "A bird in immature plummage, which I took to belong to this species, I saw in a clump of choke cherry bushes on a branch of Milk River, near Bears Paw mountains, Nebraska." The date is approximate, but it was between Aug. 18 and Sept. 6. Reference: Cooper, James G. and Suckley, G., "The Natural History of Washington Territory . . ." (in "Reports of Explorations and Surveys . . . 1853-55," Washington, 1860).
11. Aug. 8, 1856. Near Wolf Point. The Warren Expedition collected a male "above Fort Union." Reference: Baird, S.F., *et al.*, "Reports of Explorations and Surveys . . ." Washington, 1858. R. C. Banks (personal communication) states this specimen (USNM 5418) was collected 70 miles above Fort Union and was destroyed in 1881.

? Late summer, 1859 and/or 1860. Yellowstone drainage. According to A. W. Schorger ("The Passenger Pigeon: Its Natural History and Extinction," University of Wisconsin Press, Madison, 1955), Hayden (Hayden, F. V., "On the Geology and Natural History of the Upper Missouri," *Transactions of the American Philosophical Society News Series,* 12:171, 1863) "saw small flocks 'high up on the Yellowstone' and considered species little more than a straggler in far west, not over a hundred individuals being seen in a season."

12. June 18, 1860. Near Poplar, on the Missouri River. Cooper: "The Wild Pigeon (*Ectopistes migratorius*) also breeds here." Reference: Cooper, James G., "Notes on the Fauna of the Upper Missouri," *American Naturalist*, 3:294-299, 1869.

? June 21-Aug. 18, 1860. Poplar to Helena, along the Missouri River. Cooper: "Along the Missouri I often saw small flocks." Reference: Saunders, A. A., "A Distributional List of the Birds of Montana," *Pacific Coast Avifauna,* No. 14, Berkeley, 1921.

13. Aug. 18-Sept. 9, 1860. Helena to Idaho border on old Mullan Road, which approximates present U.S. 12 (Helena to Missoula) and U.S. 10 (Missoula west). Cooper: "The Passenger Pigeon, like the Cat-bird, astonished me by its frequency in the Rocky Mountains, as, although I saw no very large flocks, I saw some almost every day until I passed the Spokan Falls, just north of the Columbia Plains, where Lieut. A. V. Kautz shot two. . . . In the mountains they fed, in August, chiefly on the service-berry (*Amelanchier alnifolia*), which along the Hell Gate, attains a size and flavor unequalled by any I have seen elsewhere." Reference: Cooper, James G., "The Fauna of Montana Territory," *American Naturalist*, 3:73-84, 1869. Cooper later (Cooper, James G., "Notes on Pacific Coast Birds," *Auk*, 7:214-216, 1890) retracted his reference to the species west of Montana.

14. Aug. 23, 1874. Chief Mountain (Waterton) Lake. A "young" bird collected by Coues (Coues, E., "Field Notes on Birds Observed in Dakota and Montana," Bulletin of the U.S. Geological Geographic Survey of the Territories, 4:628, 1878). According to Banks (personal communication), the specimen is still in the rare bird display at the U.S. National Museum.

? July 9-July 27, 1875. Between the mouth of the Yellowstone River and Carrol (an early-day settlement near the mouth of the Musselshell River) on the Missouri River. Grinnell: "Seen in small companies in July along the Missouri River bottom, where it was doubtless breeding." Reference: Grinnell, G. B., "Report of a Reconnaissance on the Upper Missouri," Washington, 1876.

derous applause of mast-laden woods. Book-pigeons cannot breakfast on new-mown wheat in Minnesota, and dine on blueberries in Canada. They know no urge of seasons; they feel no kiss of sun, no lash of wind and weather. They live forever by not living at all. . . .

The pigeon was a biological storm. He was the lightning that played between two opposing potentials of intolerable intensity: the fat of the land and the oxygen of the air. Yearly the feathered tempest roared up, down, and across the continent, sucking up the laden fruits of forest and prairie, burning them in a traveling blast of life. Like any other chain reaction, the pigeon could survive no diminution of his own furious intensity. When the pigeoners subtracted from his numbers, and the pioneers chopped gaps in the continuity of his fuel, his flame guttered out with hardly a sputter or even a wisp of smoke. . . .

It is a century now since Darwin gave us the first glimpse of the origin of species. We know now what was unknown to all the preceding caravan of generations: that men are only fellow-voyagers with other creatures in the odyssey of evolution. This new knowledge should have given us, by this time, a sense of kinship with fellow-creatures; a wish to live and let live; a sense of wonder over the magnitude and duration of the biotic enterprise. . . .

For one species to mourn the death of another is a new thing under the sun. . . . we, who have lost our pigeons, mourn the loss. . . .[13]

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2 Schorger, A. W., "The Passenger Pigeon: Its Natural History and Extinction," University of Wisconsin Press, Madison, 1955.

3 Robbins, C. S.; Bruun, Bertel, and Zim, Herbert S., "Birds of North America," Western Publishing Co., Inc., 1966.

4 Skarr, P. D., "Passenger Pigeon Records in Montana," (unpublished manuscript).

5 Thwaites, Reuben Gold, editor, "Original Journals of the Lewis and Clark Expedition, 1804-06," (eight volumes), Dodd, Mead & Co., New York, 1904-05.

6 *Ibid.*

7 Brewster, William, "The Present Status of the Wild Pigeon (*Ectopistes migratorius*) as a Bird of the United States, With Some Notes on its Habits," *Auk*, Vol. 6, No. 2, 1889.

8 Bent, A. C., "Life Histories of North American Gallinaceous Birds," Dover Publications, Inc., New York, 1932.

9 Audubon, John James, "The Birds of America," (seven volumes), New York and Philadelphia, 1880-84.

10 Brisbin, I. L., "The Passenger Pigeon: A Study in the Ecology of Extinction," *Modern Game Breeding*, Vol. 4, No. 12, 1968.

11 Henderson, Carrol, "Epitaph for the Passenger Pigeon," *Minnesota Volunteer*, Vol. 41, No. 240, Sept./Oct. 1978.

12 Grinnell, G. B., "Report of a Reconnaissance on the Upper Missouri," Washington, 1876.

13 Leopold, A., "A Sand County Almanac," Ballantine Books, New York, 1949. ■

Fishes of "Special Concern" *continued*

might be asked, "If these are 'fishes of special concern,' why is any harvest allowed?" For relatively fast-maturing species such as trout and grayling, the answer lies in reproductive potential. A single female cutthroat trout will produce, depending on her size, between 250 and 4,000 eggs in a spawning season. A female grayling will produce many more. Where spawning sites are not limited, the reproductive potential of such fish is so high that many more eggs and fry will be produced than the stream can support to adulthood. In most streams, including those never visited by a fisherman, less than 1% of the hatched fish live to spawn. Properly regulated fishing does not reduce the number of fish surviving to maturity.

Where long-lived game fish (sturgeon and paddlefish) are involved, more care is required to prevent overharvest. As mentioned, state regulations presently allow no harvest of white sturgeon and the paddlefish limit has been reduced. Although only a few pallid sturgeon are taken each year, we recommend even this limited harvest be curtailed.

The above listing of fishes comprises an "early warning system" or "watch list" to help ensure that the diversity of Montana fishes is maintained. For example, the shortnose gar would appear, by practical standards, to be a worthless fish. Yet it is a part of Montana's heritage and, perhaps more important, a segment of the heritage of Montana's children. They deserve the assurance that this prehistoric relict will not be heedlessly eliminated from state waters where it is native.

This "fishes of special concern" list played a significant role in a just completed evaluation of the fisheries resource value of Montana streams. Earlier evaluations in 1959 and 1965 (from which the blue ribbon trout stream concept arose) were heavily weighted toward trout fishing. This time, sport fishing for nontrout as well as trout received its full due; in addition, habitats for "fishes of special concern" were recognized even if no sport fishery was involved.

Montana's fish and wildlife managers have from the beginning had the philosophy that every species has a right to exist where it is native. With the mandate of the 1973 legislature, nongame as well as game animals can receive official recognition. ■

Readers Respond

More on "Thunder Dancing"

I am writing on behalf of the Save the Kootenai River Association, which represents a broad-based community membership of over 400 persons. We have been active in raising local awareness of the recreational and aesthetic qualities of the Kootenai River and have opposed projects which threaten to decrease the free-flowing benefits of the Kootenai.

I wanted to comment on the article in the Sept./Oct. 1979 *Montana Outdoors*, "The Timelessness of Thunder Dancing," by Pat Graham. I believe Mr. Graham presented the unbiased ecological impacts of the proposed Kootenai Falls Dam from his analysis of data as a fisheries biologist. He also carefully integrated these findings with the meaning of the area to Native Americans, so that it was a meaningful exploration of the potential sacrifices that are at stake for the Kootenai tribe, for those who have fished the quality rainbow waters above the falls and for other citizens who have learned to enjoy the tremendous variety of wildlife inhabiting the Kootenai Valley.

I commend Mr. Graham for his article and I am encouraged that this will develop a greater appreciation for the Kootenai River throughout Montana.—*Don Powell, coordinator, Save the Kootenai River Association; Libby, Mont.*

* * * * *

Like Thunder Dancing in Pat Graham's article on the proposed Kootenai Falls Dam, I cannot conceive of nor understand any project certain to destroy the beautiful Kootenai Falls area. It is unthinkable to race ahead with a project that would most certainly destroy one of the last major waterfalls, some of the Kootenai's best fishing and some critical wildlife habitat.

It seems far more reasonable to save our resources by actually beginning energy conservation and efficiency. In the future, Kootenai Falls will be much more valuable as a place to restore one's personal "energy" through its beauty, fishing opportunities and wildlife viewing than for the small amount of electricity generated by a dam.—*Tad Blank; Libby, Mont.*

* * * * *

Our sportsman's club would like to thank the Department of Fish, Wildlife and Parks for publishing Pat Graham's article about Kootenai Falls. The article was well written and it provided an objective look at the controversy surrounding the proposed dam.

It is comforting to know that our state government can be counted on to publish such a fine magazine as *Montana Outdoors*. I sincerely hope that the department and the sportsmen of Montana can continue to work together to ensure a future for Montana's wildlife heritage.—*Glen Leckrone, president, Libby Rod & Gun Club; Libby, Mont.*

More About "Wolf or Husky?"

I am writing in response to Harry and Deborah Cox's letter, "Wolf or Husky?," in your July/August 1979 letters section.

I seriously doubt if their pet husky would be shot on sight if they were fortunate enough to spend their vacation here in Montana. I also find it a bit hard to swallow that they think their pet resembles a wolf. Is he really 5 feet, 8 inches long? If so, he's a mighty big husky.

I also wonder where they keep their dogs. Are they penned or kept in a fenced yard? Or perhaps are they allowed to roam the rural spaces of Maryland (if there are any left) hunting deer?

The wolf shot north of Glasgow may have been mistaken for a feral dog or even a large coyote. The wolf is gone now, and the hundreds of thousands of "endangered" wolves that now live in Canada and Alaska miss her not a bit. They will live out their lives as predators and will be replaced by others of their kind until people from Maryland or Montana or California move into their territory and start raising huskies and yelling about the "plight of endangered wolves."—*Theo. J. Kosowski; Havre, Mont.*

Double Boiler Bird Bath

What's a Washingtonian doing with *Montana Outdoors?* Reading it from cover to cover, thanks to our son who is a Billings resident and who subscribed to your fine magazine for us.

With winter upon us, we'd like to share with your readers the simple directions for providing ice-free drinking water for birds. My husband—a genius by his own admission—contributes his invention without charge, for the benefit of all birds and bird lovers.

This is a double-boiler type of arrangement. Purchase a large gold panning pan; don't ask why, it just works. Pour full-strength antifreeze into the pan and place an oil dip stick heater into the antifreeze. Place an ordinary concrete bird bath on top of this. Fill the bird bath and plug in the heater. Please observe safety rules concerning the electrical portion of this project, such as sealing all connections, so snow can't enter and blow the whole thing. We've used this method for several years and it works well.

You'll need a pedestal of sorts; ours is about four feet off the ground. Even deer drink from this apparatus in the winter. We also provide bird seed, suet balls and, in severe winters such as the last, we provide grain and apples for the deer.

We live in a no-shooting area only five miles from downtown Spokane and there is a large, open corridor between us and the Little Spokane River. If they ever build houses in this corridor, the deer, quail, pheasants and my husband and I are moving to Montana.—*Marian A. Baran; Spokane, Wash.*

Masked Bandits, Cavity Nesters

I have been a subscriber to your magazine for a number of years. I have just finished reading the July/August 1979 issue and found it most interesting, especially the article, "Masked Bandit of the Night." The pheasant is gradually disappearing in certain sections of our state and many farmers have told me that is due to the scarcity of young birds which, in turn, is due to the raccoon. These farmers have witnessed the raccoon following the fence rows and destroying the pheasants' nests and eating the eggs or young pheasants. Of course, the raccoon is now being trapped due to the value of its fur; as a result, damage to the pheasant nests has decreased.

I also enjoyed the article on cavity nesters, "Part of Montana's Bird Heritage." My yard has many trees which have been nesting places for a number of the birds mentioned in your article, including the flicker, chickadee, flycatcher and others. But the sad thing

recycled paper

is that many of the trees providing nests are being cut down due to the energy crisis and the fact that many people are installing wood-burning stoves. Dutch elm disease is also contributing to the loss of many trees. I feed birds all winter, including the chickadee, nuthatch, pine siskin, redpoll, downy woodpecker, blue jay (and, of course, squirrel).

Thanks for *Montana Outdoors.—Richard L. Waltner; Freeman, S.D.*

The Importance of Being Courteous

The opening of the pheasant season brought about the usual anticipation of a glorious day in the field shared with my husband and our German shorthaired pointer. However, our enthusiasm soon turned to utter frustration as we started up through a draw. Three other hunters who arrived after we had charged in front of us, thereby blocking any shots we might have had. Needless to say, our day was completely spoiled.

For 15 years, we owned and operated Gunners' Mark Game Preserve, the first successful preserve in Colorado. In conjunction with the preserve, we started one of the earliest shooting schools in the country. I became a National Rifle Association instructor, teaching both adults and youngsters the art of wing shooting. Hunting etiquette was certainly included, as well as shooting and safety instruction.

I fervently hope all Montana instructors will include field manners as an important segment of their hunter safety programs. Perhaps then we will be able to call hunters of the next generation true sportsmen.—*Anne M. Howe; Livingston, Mont.*

The Best of Both

The July/August 1979 copy of *Montana Outdoors*, provided in my registration packet at the recent American Fisheries Society meeting in West Yellowstone, is the first issue I have ever seen.

The purpose of this brief note is to commend the staff for a beautiful job. A number of state outdoor publications are remarkable for their beautiful photos and others for their well-written and timely text. *Montana Outdoors* combines the best of both and I'm truly impressed.

I hope Montana outdoorsmen appreciate what they have and what a bargain it is at $5 per year.—*Carl R. Sullivan, executive director, American Fisheries Society; Bethesda, Md.*

Scenery Was the Highlight

My family and I recently spent two weeks in Montana visiting my brother who lives in Billings. Although I didn't do any hunting, I really enjoyed the fishing. But the highlight of the trip was the scenery of the country.

We took a two-day trip down to Yellowstone National Park and the view from around Beartooth and Colter passes was beautiful. If you do not have *the* most beautiful state, then I would love to see the one that is more beautiful.—*Al Downs; Paducah, Ky.*

Something for Everyone

Your magazine is beautiful! It is thoroughly enjoyable and the articles are of great interest. I could rave on. Congratulations to all of you for all the time and effort you spend to produce such a masterpiece.

My husband is the hunter and fisherman—not I—but I enjoy the magazine as much as he does. So see, your magazine is for everyone.—*Lillian Reiff; Kutztown, Penn.*

Book Reviews

THE MASTER BACKWOODSMAN, by Bradford Angier, Stackpole Books, 1978, 224 pages, $9.95 hardbound.

Today, with the increasing lure of the wild, thousands of people are putting their newly purchased packs on their backs and "hitting the trail." Many don't realize their "adventure" may be miserable, full of cold nights, blisters and undernourishment. Does a pack trip, canoe trip or even just a night in a park have to be this way? No.

It takes a great deal of experience and patience to truly feel a part of the outdoors, to understand it on its own terms. With publication of his 29th book on outdoor skills, Bradford Angier has once again shown he understands how to survive in style while off the beaten path.

While he has proved he is a qualified and experienced "backwoodsman," he has not proved he is a photographer. Nearly all the books Angier has published have had excellent and extremely helpful camping, cooking, survival and how-to-enjoy-the-woods hints. Unfortunately, the photographs which are supposed to supplement his hints are frequently out of focus and detract from the publication's quality.

This book contains some helpful information: how to make a "browse bed" for a comfortable night's sleep, how to increase the heat output of a fire with natural reflectors, how to detect and cope with hypothermia and how to find directions without a compass.

There is no way any single book can explore all of the needs, preparations, precautions, equipment or knowledge that it takes to enjoy the wilds. That knowledge can come only with time, practice and patience. If a person is interested in becoming more aware of how to be physically comfortable away from paved streets, he can read, then experience. Eventually, the two will come together. "The Master Backwoodsman" is a fine aid, but experience is the real teacher.—*Craig Sharpe, motion picture production unit supervisor*

THE ANGLER'S COMPANION, compiled by Brian Murphy, Paddington Press Ltd., New York, 352 pages, $10, hardbound.

"The Angler's Companion" is a charming and witty collection of short stories, poems and anecdotes by some of the world's best known writers.

I would give two bits of advice to anyone who reads this book: First, read it during the fishing season. Second, if you insist upon reading it at a time other than the fishing season, prepare your family for some odd behavioral patterns you will soon display. While reading it, I found myself sorting through last year's tangle of spoons and spinners, rearranging my already neatly packed fly box for the umpteenth time and standing in the backyard practicing my spot casting with a size 18 light Cahill into the cool, still waters of a rust-impregnated wheelbarrow.

I guarantee the reader will find himself reminiscing about that first six-inch brook trout or peppery bluegill that destined him to become a died-in-the-hackle fisherman for his remaining years. You will find yourself chuckling about the water-logged waders and misplaced tackle boxes of days gone by.

Ernest Hemingway's "Big Two-Hearted River," R. D. Blackmore's "Crocker's Hole" and several reviews of Izaak Walton's "The Compleat Angler" are a few of the works included in "The Angler's Companion." The stories begin with the 15th century and the invention of the first artificial flies and extend into the 1970s and modern-day tackle.

Several of the older works are written in a sometimes difficult-to-understand prose style. However, "The Angler's Companion" is generally very easy to read and would be a welcome addition to any fisherman's library.—*Chris Clancey, fisheries biologist, Miles City*

Montana's Trophy Records

Trophy hunting for big game species, and the certification of record trophies by the Boone and Crockett Club, have a long and respectable history in America. The Boone and Crockett Club was founded in 1887 by Theodore Roosevelt (13 years before he was elected to his first term as President and 14 years before he took his world record cougar at Meeker, Colo.), as an association of politicians, military leaders and scientists devoted to hunting for big game. The club's first records book was published in 1932, listing top trophies in each of 27 categories and rated according to length of horn, antler or skull.

Since that time, six more editions of the official Boone and Crockett records volume have been published, the most recent in 1977. The 1977 edition, "North American Big Game," was co-sponsored by the National Rifle Association. It contains a healthy representation of Montana animals, such as the seven-point bull elk killed in Madison County in 1958 by Fred Mercer—still the third-ranking elk ever taken.

In 1950, the club replaced its original system of simple horn, antler and skull measurements with a more comprehensive system that takes account of other important features (such as symmetry) affecting the desirability of the trophy, to derive a single overall score. Boone and Crockett records now also recognize 31 categories of big game, some corresponding directly to species, some to geographically separate populations within species, some to other distinctions. Included as categories, for instance, are Black Bear, Grizzly Bear, Alaska Brown Bear, Atlantic Walrus, Pacific Walrus, Mountain Caribou, Woodland Caribou, Bighorn Sheep, Dall's Sheep, Stone's Sheep, Mule Deer (typical antlers) and Mule Deer (nontypical antlers). Spread throughout the country are roughly 300 official volunteer Boone and Crockett measurers—including several members of the Montana Department of Fish, Wildlife and Parks—who contribute their time and knowledge to make the Boone and Crockett certification program work.

With the rise of interest in bow hunting, archers eventually established their own equivalent of Boone and Crockett: the Pope and Young Club, named in honor of Dr. Saxton Pope, the father of modern bow hunting, and his hunting companion, Art Young (who together

MONTANA TROPHY RECORDS—POPE AND YOUNG (ARCHERY)

Species	Montana rank	Score	Locality	Date taken	Taken by or (owner)	Pope & Young rank (1975)
Elk	1	369 2/8	Madison County	1977	Jeff Engler	—
	2	366 7/8	Mineral County	1977	Gerry Lamarre	—
	3	357 3/8	Meagher County	1978	David Snyder	—
Mule deer (typical)	1	180 1/8	Dawson County	1955	Gordon M. Quilling	35
	2	178 4/8	Carter County	1958	R. C. Tucker	39
	3	174 4/8	Gallatin County	1970	Bob Savage	60
Mule deer (nontypical)	1	218 2/8	Madison County	1972	Ken E. Engebretson	—
	2	214 0/8	McCone County	1974	James F. Kosi	—
	3	188 7/8	Dawson County	1973	Monte Dassinger	—
White-tailed deer (typical)	1	164 3/8	Wibaux County	1959	Gerald Polesku	27
	2	160 4/8	Dawson County	1978	Frank Legato	—
	3	156 5/8	Cascade County	1969	Bob Hollar	—
White-tailed deer (nontypical)	1	190 4/8	Jefferson County	1978	Jim Schilke	—
	2	177 4/8	Flathead County	1972	Jerry Karsky	30
	3	158 5/8	Roosevelt County	1973	Gene Sherman	—
Wyoming moose	1	159 1/8	Gallatin County	1960	Keith Wheat	—
	2	154 0/8	Scott Lake	1960	C. P. Mendenhall	2
	3	138 2/8	Lincoln County	1965	Thomas A. DeShazer	4
Bighorn sheep	1	176 3/8	Sweet Grass County	1968	Ray Alt	1
	2	167 1/8	Lincoln County	1974	Ron Bain	—
	3	164 2/8	Gallatin County	1973	Steve Gorr	—
Antelope	1	77 6/8	Rosebud County	1957	Joe McNutt	—
	2	77 2/8	Treasure County	1975	Tom Grunhuvd	—
	3	74 2/8	Sweet Grass County	1964	Chuck Alkire	31
Rocky Mountain goat	1	49 4/8	Ravalli County	1975	Steve Anders	—
	2	47 2/8	Kennedy Springs	1964	Don Leondorf	9
	3	46 2/8	Lewis and Clark County	1958	W. J. Fuller	18
Black bear	1	20 4/16	Madison County	1977	Bob Savage	—
	2	20 0/16	Madison County	1978	Rick Feskinan	—
	3	19 14/16	Ravalli County	1978	Dwayne Garner	—
Mountain lion	1	15 5/16	Mineral County	1979	Dennis Moos	—
	2	15 2/16	Flathead County	1971	Jerry Almos	10
	3	14 15/16	Lincoln County	1959	Allan Apling	18
	3	14 15/16	Granite County	1979	Scott Koelzer	—

were taking grizzly bear by bow as early as 1920). The Pope and Young Club has adopted the Boone and Crockett scoring system and official measurers to produce an analogous set of bow hunting trophy records. Because the effective range for an arrow is considerably less than for a bullet, minimum scores within each category are somewhat less in Pope and Young records than in Boone and Crockett. In 1975, the Pope and Young Club published its first edition of "Bowhunting Big Game Records of North America." Included are a number of Montana specimens.

The following tables, taken from the official records of these two national clubs, present the three leading Montana representatives within selected big game categories.—*Ken Greer*

This record bighorn sheep was killed by Armand H. Johnson, Missoula, on Nov. 19, 1979 near Thompson Falls. The tentative Boone and Crockett score is 200-6/8; if approved, the bighorn will become the largest on record for Montana and it will probably rank among the top 20 bighorns in the world. The trophy must dry for 60 days before an official score can be determined. Both horn bases measured 16-5/8 inches and the horns were 46 and 44-6/8 inches long (DFWP photo: Bill Thomas).

MONTANA TROPHY RECORDS—BOONE AND CROCKETT (FIREARMS)

Species	Montana rank	Score	Locality	Date taken	Taken by or (owner)	Boone & Crockett rank (1977)
Elk	1	419 4/8	Madison County	1958	Fred C. Mercer	3
	2	404 6/8	Mineral County	1959	Carl B. Snyder	9
	3	403 2/8	Valley County	1962	(R. W. Wittmayer)	—
Mule deer (typical)	1	204 3/8	Ravalli County	1973	Sherman Williams	43
	2	199 7/8	Stillwater County	1968	Basil C. Bradbury	125
	3	197 6/8	Jefferson County	1964	James Rowe	177
Mule deer (nontypical)	1	275 1/8	Ruby Mts.	1960	Peter Zemljak	35
	2	270 6/8	Highland Mts.	1962	Peter Zemljak, Sr.	46
	3	270 5/8	Bighorn County	1961	Roger Turnsback	48
White-tailed deer (typical)	1	198 1/8	Missoula County	1974	Tom Dellwo	9
	2	196 4/8	Flathead County	1966	Kent M. Perry	—
	3	191 5/8	Flathead County	1963	Earl McMaster	19
White-tailed deer (nontypical)	1	252 1/8	Hill County	1968	Frank A. Pleskac	13
	2	241 7/8	Flathead County	1960	George Wolstad	30
	3	234 1/8	Glacier County	1968	(Larry W. Lander)	42
Wyoming moose	1	195 1/8	Red Rock Lakes	1952	C. M. Schmauch	5
	2	186 1/8	Hamilton	1957	(George Beechwood)	7
	3	179 7/8	Gallatin County	1930	John Williams	19
Bighorn sheep	1	196 5/8	Sun River	1961	Don Anderson	19
	2	195 7/8	Montana	1890	(Dole & Bailey Inc.)	24
	3	195 5/8	Park County	(1976)	(Rodney Lawrence)	—
Antelope	1	92 6/8	Garfield County	1977	Don Yates	—
	2	89 6/8	Rosebud County	1973	Jim Ollom	10
	3	88 0/8	Sweet Grass County	1971	William S. Amos	19
Rocky Mountain goat	1	51 6/8	Lake County	1958	Glenn Conklin	80
	1	51 6/8	Wolf Creek	1963	Jim B. Beard	80
	1	51 6/8	Flathead County	1965	John J. Allmaras	80
Bison	1	131 6/8	Hell Roaring Creek	1945	(Univ. of Montana)	6
	2	126 2/8	Yellowstone River	1935	(Edward Melby)	16
	3	125 2/8	Montana	before 1891	(O. P. Chisholm)	20
Grizzly bear	1	25 9/16	Missouri Breaks	1890	E. S. Cameron	41
	2	25 7/16	Upper Boulder River	1934	Ted Johnston	49
	3	25 0/8	Lewistown	1888	Mildred Connor	90
Black bear	1	20 15/16	Bighorn County	1972	Sam Notafraid	—
	2	20 14/16	Lincoln County	1967	Robert Livesay	—
	3	20 13/16	Park County	1976	Charles Burdette	—
Mountain lion	1	15 11/16	Darby	1953	Lowell Hays	6
	2	15 8/16	Lincoln County	1975	Robert Fleshman	17
	3	15 7/16	Lewis and Clark County	1967	Ron Jenkins	21

The Middle of Nowhere

Montana's Endangered Species

by Dennis Flath

photo: Jerry M

1975). As a result, endangered species programs did not receive the anticipated impetus. For a time, in fact, more federal funds were available than could be matched by the few qualifying states.

In 1978, the Endangered Species Act was amended, making qualification requirements more lenient so that additional states might become involved. Even though more states are now qualifying for grant-in-aid funds, the appropriation has not been increased. The result is that federal funds available for state endangered species programs are now inadequate to meet the demand. (See "New Hope for Reasonable Solutions," *Montana Outdoors*, July/August 1979.) These limited funds must be divided into many more pieces, and some states which qualified early are facing substantial cutbacks. Montana is one of the newcomers. The Department of Fish, Wildlife and Parks (DFWP) has recently signed a cooperative agreement with the U.S. Fish and Wildlife Service (FWS) and actual funding support is expected to begin soon.

The grants are made on a 2-to-1 matching basis: two federal dollars granted for each dollar put up by the state. This looks good on the surface, but it is subject to limitation, both by the amount of funds which a given state can apply to the formula, and by the amount of federal funds available for all endangered species grants. For now, the maximum possible grant available to Montana is $30,000. This will require a state commitment of $15,000 to endangered species preservation. The resultant $45,000 total is just a portion of what could be put to effective use.

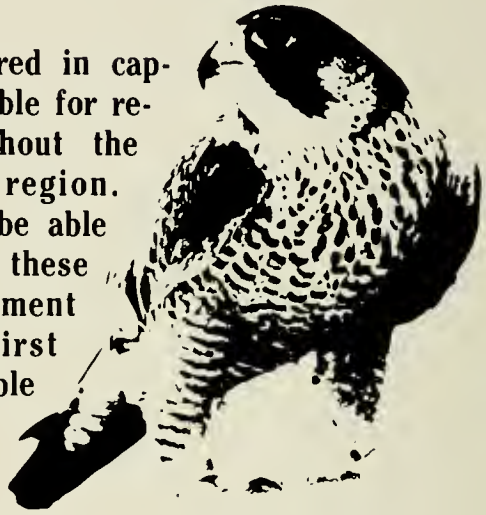
If these funds were divided evenly for work with the peregrine falcon, bald eagle, whooping crane, wolf and black-footed ferret, the tangible benefits to each individual species would be insignificant. We must therefore focus our efforts selectively, judging which species have the most urgent needs, and which activities will produce the greatest results. Until the funding base has been expanded, other endangered species will have to wait. Such choices will be hard, but necessary, if we are to see progress in our endangered species program.

Plans have accordingly been made to devote initial efforts toward the peregrine falcon and bald eagle, while continuing only modest informal surveys of the wolf and ferret. Occurrences of migrant whooping cranes will be routinely recorded.

Peregrine chicks bred in captivity—at a facility in Fort Collins, Colo., run by a nonprofit group known as The Peregrine Fund—are now available for reintroduction throughout the Rocky Mountain region. Montana may soon be able to take some of these chicks, but department biologists must first identify and evaluate possible transplant sites. The preliminary step will be to locate prairie falcon eyries (nests) that might be suitable for cross-fostering (the technique of entrusting young of one species to the parental care of another species). These eyries must be on relatively high cliffs, isolated from human intrusion. They must also be remote from nests of great horned owls or golden eagles, both of which have been known to kill peregrine chicks. Once such eyries have been located, researchers will examine the prey base (the supply of potential food species which, for peregrine falcons, consists mainly of other birds). Researchers will walk the area to inventory the numbers and kinds of prey species; some specimens of potential prey will be collected and analyzed for pesticide contamination. Only those sites where the prey base is free of contamination will be considered for peregrine transplanting.

The next step will be to obtain captive-bred chicks from the Fort Collins facility and substitute the peregrines in place of prairie falcon chicks. The adult prairie falcons will then raise the peregrine chicks as their own. The displaced prairie falcon chicks will be added to other prairie falcon eyries.

"Peregrine chicks bred in captivity are now available for reintroduction throughout the Rocky Mountain region. Montana may soon be able to take some of these chicks, but department biologists must first identify . . . possible transplant sites."



Other department activities on behalf of the peregrine falcon will continue. Locations of migrant peregrines will be routinely recorded and individual "salvage" operations will be conducted as occasions arise. One example of the latter occurred last summer, when a peregrine probably suffering from botulism was found in south central Montana. Through the combined efforts of the DFWP and the FWS, that bird was rehabilitated and returned to the wild. (See "The Catchall" article by Bill Pryor on p. 7.)

The bald eagle's status in Montana is largely unknown. We are aware of at least 15 nest sites, but suspect there may be more. Forthcoming department surveys will attempt to discover additional sites; yet to survey all possible locations where bald eagles may nest will probably take many years.

The reproductive success of Montana's bald eagles is also something of a mystery. While the nesting site

surveys are in progress, we intend to check all known sites for occupancy. Occupied sites will then be rechecked in midsummer to determine how many young have been produced. At the same time, management recommendations will be prepared toward preserving these few nesting sites and the habitat that surrounds them. We also hope to identify key areas used by migrant and wintering bald eagles.

The DFWP is not alone in its efforts to preserve Montana's endangered species. The National Wildlife Federation has instituted an annual midwinter bald eagle survey. The first survey, conducted in January 1979, recorded 261 bald eagles in Montana. The U.S. Forest Service and the Bureau of Land Management (BLM) also have responsibilities regarding endangered species, and their programs gain impetus every year. For example, BLM wildlife biologists Lew Myers and Jon Sadowski have conducted intensive bald eagle surveys on the Dillon Resource Area during the past two years. They have compiled much valuable information and this year their effort is slated for expansion. One active nest site is already the subject of BLM management guidelines designed to protect and perpetuate the eagles and their habitat in that vicinity.

Development of a program to help endangered species recover is itself a worthy goal, but equally important are preventive efforts seeking to keep the list of such species from growing any longer. Montana today has relatively few endangered species—but mainly because it is a large state, with much high-quality habitat still unexploited by man.

What are the prospects for keeping the "endangered" list short? Montana harbors numerous species of nongame wildlife, their status in the struggle for survival completely unknown. Many are rare, restricted in range and may be very sensitive to alterations of their habitat. Just a small amount of additional habitat disturbance, in some cases, could reduce these species to threatened or endangered status. Of roughly 435 nongame vertebrates in Montana, 75 possess this combination of characteristics—including a few which are already endangered. The department has designated these unknown, rare, restricted and sensitive nongame species as being of "special interest or concern." That designation should in no way be confused with classification as "endangered" or "threatened." The "special interest or concern" rubric is intended rather to identify inconspicuous or delicate species that *may eventually* be jeopardized (but are not necessarily jeopardized yet), and to highlight them for further study that could prove invaluable if their survival ever becomes a matter of uncertainty.

An ounce of prevention really is worth a pound of cure. Since the beginning of our nongame and endangered species program in 1974, the department has held that sound management action to maintain sensitive species is both easier and cheaper—and ultimately more reliable—than emergency efforts to rescue severely endangered cases from the brink of oblivion. A successful nongame program will complement a good endangered species program by safeguarding sensitive species and keeping the "endangered" list small.

Likewise, sound management programs for game animals, particularly for such highly demanding species as elk, will include provisions (paramount among which will be those that foster sound land-use practices) for maintenance of high-quality habitat. This action will automatically meet the habitat needs of a wide variety of nongame species as well.

To the extent that we succeed in this compound endeavor—wise use of land, habitat preservation, careful attention to rare and sensitive species—we will be successful in holding to a minimum Montana's list of threatened or endangered species. And we will do so with substantial savings of money, time and frustration. ■

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Great Horned Owl: White-Throated Hooter by Stephen Freligh

EVERY SPRING, volunteers like myself, in Montana and throughout the United States, spend hours of free time locating and banding unfledged young of the great horned owl. These efforts, sponsored by the U.S. Fish and Wildlife Service (FWS), provide a means of tracing horned owl movements and yield valuable information for ornithologists researching the species. Each aluminum leg band bears a number coded to the place and date of banding; this information is programmed into a central computer in Maryland. When a banded owl is recaptured or found dead, the second location and date also go into the Maryland computer and the correlated information stands available for researchers studying horned owl behavior. Anyone can contribute to this program by reporting banded birds to the Montana Department of Fish, Wildlife and Parks or, more directly, to a regional office of the FWS.

The great horned owl (*Bubo virginianus*) is common throughout Montana, nesting on ledges and in the hollows of cliffs, in cottonwood trees along stream banks and occasionally in abandoned buildings. Because of its relatively early courtship season, it often succeeds in appropriating the established nests of other raptors. This owl is easily distinguished by its large size (18-25 inches long) and by the two tufts of feathers that protrude from its head like ears or horns. Large yellow eyes contrast with its mottled grey-brown body and its dark, horizontally barred chest. Many birdwatchers confuse the long-eared owl (*Asio otus*) with the great horned because of their similar plumage, but on closer observation the great horned can be recognized unmistakably by its white throat, especially noticeable when it is hooting.

During courtship, the great horned owl is particularly vocal, with several hoot variations: One version resembles the bark of a large dog, one resembles a whistle and one a shrill human scream (this last being most comfortably witnessed in the company of friends). By mimicking the hoots, a patient person can often call one of these owls in for a closer look—particularly when, with young in the nest, the adults are most protective.

In mid-February, the female lays from two to four white eggs. After the first young owl hatches, both adults become extremely defensive and will fiercely attack any intruder. When a group of us are banding nestling owls, we often flip a coin to decide who will climb the nest tree. The climber must be well protected, with a helmet, a heavy shirt or jacket and a safety belt girding him to the tree. Sometimes both adults will attack at once, leaving the climber hard pressed to escape the powerful blows. A relieved expression usually lights up the face of any climber returning to the ground unscathed.

Great horned owls are not strictly nocturnal. Although they spend much of the day secluded in dense cover to escape the harassment of magpies and crows, in Montana many have been observed hunting during daylight hours. Small mammals comprise most of their diet. They also feed on reptiles, birds and even other raptors, depending on the availability of prey species and the need of parent owls to supply food for their young. A great horned will usually carry its prey off and eat it in a nearby tree to reduce the risk of losing the meal to another predator.

All birds of prey in the United States are protected by law, but many great horned owls—including some that I have banded—are nevertheless killed. Unfortunately, enforcement is difficult and it requires cooperation from the public. Many people are unaware of the important role these birds play, through their harvest of mice and other prolific mammals, in maintaining the balance of our ecosystem. The great horned owl is a formidable and useful creature but its numbers in Montana are decreasing. As an integral part of Montana's wildlife scene, it is worthy of your interest and concern. ■

photo: Danny On

Audubon Bighorn Sheep *continued*

Missouri River Breaks, roughly 10,000 years ago, could easily have supplied them with a suitable corridor to the badlands of eastern Montana and the western Dakotas. As the Pleistocene glaciers spread over northern Montana, the Missouri River was forced from its original channel, near where the Milk River now runs, and crowded southward. Cutting a new channel along the southern edge of the ice, the Missouri carved a narrow valley through the strata of sedimentary rock. When the glaciers receded, newly formed streams forged a maze of steep-walled coulees: the Missouri Breaks.

Audubon aptly described this country during his 1843 trip:

> The only idea I can give you in writing on what are called Mauvais terres would be to place some thousands of sugar loaves of different sizes from quite small and low to large and high, all irregularly truncated at top and placed somewhat apart from each other. No one who has not seen these places can form any idea of the resorts of the Rocky Mountain Rams or the difficulty of approaching them, putting aside their extreme wildness and marvelous activity.[10]

If the breaks served as their portal of entry, Audubon sheep then could have easily expanded their range throughout eastern Montana and into the Dakotas.

Ken Thompson, a former employee of the Department of Fish, Wildlife and Parks (DFWP), believed the sheep followed the Missouri corridor and then branched north and south, utilizing tributary corridors as stepping stones to suitable habitats.[11] I tend to agree with Thompson's theory: On many occasions, I have stood at the mouth of tributaries on the Missouri, such as Eagle, Cow and Birch creeks, and thought of their suitability as staircases to the Bearpaw Mountains to the north.

When emigrating sheep reached the mouth of the Yellowstone River, they could easily have worked their way up the major tributary to suitable habitat in the Glendive Breaks (Dawson County) and the Little and Big Sheep Mountains (Prairie County). Another group could have followed the Powder River south to the Blue Mountains (Custer County), Ekalaka Hills, Chalk Buttes, Long Pines, Sheep Mountains (Carter County) and the Powder River Breaks (Powder River County). The Tongue River drainage probably provided access to the Ashland Breaks in Rosebud County. From the scattered documentations of Audubon sheep in eastern Montana, they probably utilized all suitable habitats.

Information on relative numbers of Audubon sheep is unfortunately scarce and it is impossible to assess how successful they were in using the available niches. The scattered and fragmentary historical notes offer no real clues about abundance. Reports of five or 20 sheep here and dozens there are rather meaningless in the overall picture.

The various factors responsible for extinction of the Audubon sheep were related, in a complex way still not fully understood. Undoubtedly, man played the chief role. Competition from livestock was an important element, with about 600,000 cattle and a half million domestic sheep grazing in Montana during the 1880s, and no fenced or rest-rotation pastures, no feed lots and no modern livestock management practices to minimize their impact. Although its impact has never been fully evaluated, this early grazing brought profound changes to the vegetation of rangelands, altered the quality of these areas as potential wildlife habitat and contributed to the decline of Audubon bighorn sheep populations.

To further complicate the picture, a boom and bust era—unlike any before or since—hit the state during the early 1900s. By 1909, over a million acres was homesteaded. From 1910-22, 9.3 million acres went to homesteaders. By 1919, 3.5 million acres was planted in wheat and from 1909-18, nearly 80,000 people flooded into central and eastern Montana. The combination of new dry land farming techniques, the 1904-12 Homestead Acts, promotional campaigns and easy credit created one of the biggest land booms Montana has ever experienced. Its effects on wildlife, including bighorn sheep, were severe. Wild sheep populations decreased markedly because of competition for range with domestic livestock, contraction of diseases from domestic sheep and hunting.

In 1897, Edward L. Munson, assistant surgeon in the U.S. Army, wrote naturalist George Grinnell and stated that bighorns were numerous in the Bearpaw Mountains south of Havre in 1885; but by 1897, the population had been completely killed off by anthrax brought in by domestic sheep.[12]

The impact of the hunter on Audubon sheep during the late 1800s and early 1900s has not been well documented. This was a time of limited game regulation and enforcement, and the science of wildlife management had not yet been developed.

. . . the forces of geology, climate and evolution affected distribution of animals such as the bighorn sheep.

Through a combination of livestock competition, habitat loss, disease, hunting and possibly other factors, Audubon sheep populations dropped below a threshold level from which they could not recover.

It is tempting to speculate as to what the eventual fate of the Audubon sheep would have been had there been the hunter's concern for endangered species which exists today. The restoration of many species—such as antelope and turkey—can be attributed partly to the sportsmen who underwrote their salvation. For the first time, the hunter learned to sway cultural and governmental policies which brought about habitat management, better protection, restocking programs and the necessary injection of state and federal funds.

During the early 1940s, the department seriously considered introducing Rocky Mountain bighorn sheep into niches vacated by Audubon bighorns in the Missouri River Breaks. In 1947, 16 Rocky Mountain bighorns from Colorado were released within a 328-acre fenced enclosure on Billy Creek in the breaks. By 1951, 54 sheep ranged in and out of the enclosure. Abbreviated permit

hunting seasons for ¾-curl rams were conducted in 1955 and 1956. By the late 1950s, the population had started to decline and by 1963, it had disappeared, probably because of crossbreeding, disease, competition for forage and social intolerance of domestic sheep.

C. Robert Watts, DFWP wildlife biologist, and Larry C. Eichhorn, natural resource specialist for the Bureau of Land Management, speculated that the Rocky Mountain bighorns could perhaps not adapt to the breaks.[13] Their speculation was partly based on an observation of bighorn sheep made by Lewis above the mouth of the Musselshell River on May 28, 1805: "the females have already brought forth their young, indeed from the size of the young I suppose that they produce them in March."[14]

Rocky Mountain bighorns normally lamb in May. Assuming Lewis' observation was correct, could an earlier lambing period for Audubon bighorns have been molded through thousands of years of natural selection to fit the physical and biotic characteristics of the Missouri Breaks? Although such conjectures are interesting, more simplistic environmental factors probably regulate whether such introductions will be successful. The fact that bighorns are extremely active within a week of birth may have been a factor in Lewis' documentation.

Another possibility for failure of the transplant could be the bighorn's migratory patterns. In some cases, the urge to migrate is so great that transplanted sheep wander out of the area, never to return. But sometimes the opposite is true. Since migratory patterns established by resident bighorns are completely new to transplanted animals, getting mountain sheep to disperse and explore new and better grazing areas is a major stumbling block to restocking efforts. "By following the older sheep," Geist wrote, "younger rams get to know the wintering areas, the saltlicks, the rutting grounds, the summer ranges and the migratory ranges which have been passed on through each generation."[15]

Between 1958-61, 43 bighorns of Montana origin were introduced into the Two Calf Creek area of the Missouri River Breaks in Fergus County. The transplant mirrored the Billy Creek introduction in many respects, such as use of a fenced enclosure, excellent lamb production, survival for a few years and then a declining population. At this writing, the Two Calf Creek population has dwindled to fewer than a dozen animals. Possible limiting factors, in addition to those attributed to the Billy Creek failure, include the severe winter of 1971-72, competition from deer for forage and dispersal into unfavorable habitat.

Another introduction of bighorn sheep from Montana was attempted in the Blue Mountains of southeastern Montana in 1958. The initial introduction of 11 sheep into an area formerly inhabited by Audubon sheep increased to about 65-70 animals by 1965, when special limited hunting permits were issued for ¾-curl rams. Surveys from 1966-68 indicated the population had decreased to about 45 sheep and that they had dispersed widely—one group was observed 90 miles from the release site.

An additional stocking of 25 bighorns from the Sun River Wildlife Management Area was made in 1976. Current observations indicate the Blue Mountains herd has between 100-125 animals in it and that the number is in tune with the carrying capacity. Transplanted sheep in the Blue Mountains have been an exciting addition to Montana's wildlife and hunting scene—a fitting tribute to Montana sportsmen who worked so hard to ensure the bighorn sheep transplants would be successful.

More than 50 years has elapsed since man last saw an Audubon bighorn sheep. With that disappearance, the world lost a segment of its gene pool that can probably never be duplicated.

Survival has always been problematic, and evolution has functioned like a merciless Grim Reaper, wiping out the insecure species, the uncompetitive, the misplaced and outmoded, sometimes even the seemingly formidable. Lost in the vastness of time lies a tangle of reasons for those disappearances. Yet one thing is clear: All those extinct life forms succumbed, as evolutionary processes unfolded in one continuous chain of essentially random changes. Part of that sequence changed when man entered the picture.

I think of that influence every time I walk through our Miles City regional office, and look at the Audubon bighorn sheep displayed there.

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Fishes of "Special Concern"
See page 2